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LEFEBVRE (C. L.) & STEVENSON (J. A.). **The fungus causing zonate leafspot of Cowpea.**—*Mycologia*, xxxvii, 1, pp. 37–45, 2 figs., 1945.

During 1943, cowpeas in the southern States were affected by a disease previously attributed to *Amerosporium oeconomicum* [*R.A.M.*, xxii, p. 127] and designated in this paper zonate leaf spot. The spots are generally more or less circular, but they may coalesce and become irregular. As the fungus develops in a lesion, the tissue becomes brittle and papery, the whole lesion finally dropping out. The pycnidia are generally produced in this white, papery centre, but sometimes they extend beyond it, in the brownish-red tissue forming the outer portion of the spots. They are usually spherical, erumpent, epiphyllous, and range from 155 to 260 (average 208) μ in diameter. The circular ostiole measures 15 to 30 (average 23) μ in diameter, and is surrounded by a ring of more or less upright setae. These are blackish-brown at the base and become lighter towards the tip; they are 0- to 6-septate, straight, and 30 to 170 by 6 to 15 μ. The rather pointed, oblong conidia have 1 to 7 (mostly 3) septa, and measure 16 to 42 by 4 to 6 (average 26 by 4·7) μ; in immature pycnidia many conidia are non-septate.

The fungus is renamed *Aristastoma oeconomicum* (Ellis & Tracy) Tehon, n. comb. (syn. *A. concentrica*) [*R.A.M.*, xii, p. 788]. It occurs in the United States on leaves of cowpea, *Phaseolus* sp., *P. angularis*, *P. max*, *P. radiatus*, and bean (*P. vulgaris*). Reports of the fungus on *Dolichos* spp. and *Vigna catjang* are, properly, on cowpea.

WILLIAMS (W. O.). **Grape-Vine injection apparatus.**—*Science*, N.S., ci, 2625, pp. 416–417, 1 fig., 1945.

The author describes in detail an apparatus for the injection of zinc sulphate solutions into vines affected by zinc deficiency. This method gives much better results than spraying foliage or daubing fresh pruning wounds. The apparatus consists of a soft steel injection point with a radial outlet which is forced into the vine stalk by means of a screw wood clamp. The solution is injected by means of a grease gun attached to the steel point. This pump is calibrated by means of a 250 ml. burette and delivers about 1·66 ml. per stroke. Brass or other non-corrosive metal should be used in the construction of the pump. A dose of 5 ml. 25 per cent. zinc sulphate has given marked improvement in the appearance of zinc-deficient cane-pruned Thompson seedless vines.

Annual Report of the Department of Agriculture, Jamaica, for the year ended 31st March, 1944.—16 pp., 1945.

In this report [cf. *R.A.M.*, xxiii, p. 427] it is stated that during the period under review 690 tons of copper sulphate and 1,300 spraying units were issued to banana-growers in the campaign against leaf spot [*Mycosphaerella musicola*: ibid., xxiii, p. 428] in Jamaica.

Pimento disease [rust *Puccinia psidii*: loc. cit.] has restricted the production of this crop to certain defined areas.

Further work was carried out on the development of banana varieties resistant to Panama disease [*Fusarium oxysporum* var. *cubense*: loc. cit.] and leaf spot. In addition, field trials were begun with established varieties immune from Panama disease, though not from leaf spot. It is estimated that even if a satisfactory marketable immune variety is bred immediately, it will be about ten years before any substantial quantity can be produced for export. The chief interest centres round SA 1 [loc. cit.], but no pronouncement as to its potentialities is possible at present.

A study was made of the effect of climatic factors on the viability of the conidia of *M. musicola* produced on banana leaf spots in one locality throughout the year. It was found that the low night temperatures in the cooler months retard conidial development to such an extent that maturity is not fully reached when the dew dries on the leaves in the morning. Spore viability (assessed by recording mortality after the spores had been placed on the surface of a heart leaf and left to germinate for a week) was ascertained to be closely connected with the state of maturity of the conidia. Mortality was highest in the colder months, and the rate of growth of the germ-tubes was slightly retarded by the lower temperatures. These results explain the regular seasonal drop in conidial infection during winter, which does not become apparent until the effect is seen on the comparatively healthy foliage in March or April.

Experimental work, together with a detailed analysis of earlier records, proved conclusively that the rate at which spots appear on a leaf is directly proportional to the intensity of infection per unit area of leaf surface, a heavily infected part of a leaf forming the individual spots much more rapidly than a lightly infected part. In interpreting records of disease intensity at any time of the year, it is essential to take into account the fact that the amount of spotting on any one leaf depends upon the intensity of infection and the age of the leaf, or, conversely, that when the age of a leaf is known, the amount of spotting directly indicates the intensity of infection when the leaf opened. Seasonal fluctuations in disease intensity can therefore be calculated by comparing records of disease either on all the individual leaves of a few plants at any one time of the year, or on leaves of similar age at different times of the year. The extent of latency in spot development depends, apparently, on the amount of toxin secreted by the primary infection hyphae while developing intracellularly after penetration of the stomata; the heavier the infection per unit area of leaf surface, the greater the quantity of toxin released, and the quicker the loss of resistance by the cells of the leaf tissues. Evidence of the existence of a toxin is shown by the yellowing of the tissue round a leaf spot but not round a hole made by mechanical injury.

Spraying trials were carried out on plots of 5 to 25 acres throughout the island to demonstrate the basic principles of control, i.e., (1) the attainment of maximum control in summer, upon which control in winter depends, since three- or four-weekly spraying cycles do not give satisfactory control of ascospore infection, and (2) that the safest time to suspend spraying is in January and February. Records were made of the spotting on individual leaves of parents and followers separately in order to estimate in detail what was the fluctuation of infection. It was found that the plots could be divided into those showing definite evidence of out-of-season tip-spotting (ascospore infection) in August, and those without such spotting. The latter were maintained under excellent control throughout the year, but there was a close correlation between the intensity of tip-spotting in August and the severity of this form of the disease in February, demonstrating clearly that three- to four-weekly spraying cycles do not give satisfactory control of ascospore infection.

Bronze leaf wilt of coco-nuts (loc. cit.) continued to cause considerable losses in the north-western part of the island, but a tendency to spread eastwards was

checked by preventive measures. The decision was taken to treat the disease as if it were infectious: a clearance was made of diseased palms on the north-west coast, first at Trelawny, which is on the edge of the affected area, and then in Hanover and St. James. Over 18,000 palms were felled. Legislation was introduced to enforce the destruction of diseased palms where necessary (Bud Rot and Wilt Disease of Coconuts Order of 30th November, 1943). Burning has not been enforced where the disease was already epidemic and few palms remained, but it is carried out when cases occur in new areas. A general clearance of diseased palms having been effected, fresh cases can be dealt with promptly as they arise.

A mosaic disease-resistance trial with recently imported sugar-cane varieties gave the following results: mosaic-free, B 39184, B 39207, B 39211, B 39213, B 39214, B 39220, B 39223, and B 39257; slightly infected (1 to 3 diseased stools), B 39157, B 39192, B 39215, and B 39222; moderately infected (4 to 6 diseased stools), B 39177 and B 39199; largely infected (7 to 9 diseased stools), B 39198 and B 39200; and very largely infected (11 diseased stools), B 39240.

The following diseases were recorded for the first time in Jamaica: *Cercospora abchazica* causing leaf spot of *Datura suaveolens*, *Alternaria oleracea* causing leaf spot of Chinese cabbage, *C. ricini* causing leaf spot and *Phomposis* sp. leaf blotch of castor oil [*Ricinus communis*], *Helminthosporium sacchari* causing leaf spot of elephant grass (*Pennisetum purpureum*), *Macrosporium parasiticum* [*Pleospora herbarum*] causing onion leaf blight, and *Erwinia carotovora* causing soft rot of the same host. A fungus causing fruit rot of loofahs [*Luffa* sp.], formerly listed as *Macrophoma* sp., was identified as *Botryodiplodia theobromae*.

Fifty-fifth and fifty-sixth Annual Reports of the Texas Agricultural Experiment Station, 1942–3.—45 pp. [? 1944. Received May, 1945.]

This report [cf. *R.A.M.*, xxii, p. 53] contains, *inter alia*, the following items of interest. E. S. McFadden and P. B. Dunkle found that the Rio and Viking flax varieties were highly resistant to rust [*Melampsora lini*: ibid., xxiii, pp. 342, 437]; Norsk and a variety from Turkey, C.K. 862, also proved resistant.

P. R. Johnson has made selections from Blackeye cowpeas resistant to nematodes [*Heterodera marioni*] and *Fusarium* wilt [*F. bulbigenum* var. *tracheiphilum*: ibid., xiv, p. 208]. These selections are almost identical with Blackeye in other respects.

E. S. McFadden, P. B. Dunkle, J. R. Quinby, I. M. Atkins, and H. O. Hill state that a soft red winter wheat, Austin, resistant to stem rust [*Puccinia graminis*] and leaf rust [*P. triticina*], was released to commercial growers in 1942. Two new varieties of hard red winter wheat, Comanche [ibid., xxiii, p. 292] and Wichita, are being distributed. The former, a cross between Tenmarq and Oro, is resistant to bunt [*Tilletia caries* and *T. foetida*], and is superior to Tenmarq in yield, test weight of grain, and resistance to leaf rust. Wichita is a selection from a cross between Early Blackhull and Tenmarq, and in its milling and baking qualities is greatly superior to Blackhull.

P. A. Young states that in tests with Purplehull, which developed 55 per cent. ashy stem blight (*Sclerotium bataticola*) [*Macrophomina phaseoli*], only 6 per cent. of Blackeye [cow]pea No. 8152 become infected. L. M. Blank found that, in three years' tests, early-maturing cotton varieties outyielded late ones by a very significant margin, though the amount of root rot (*Phymatotrichum omnivorum*) in the two groups did not differ significantly. A high-nitrogen fertilizer reduced root rot and increased yields by a highly significant margin. A high-phosphate fertilizer had almost no effect on root rot or increased it, though in the latter case the yield was increased.

F. M. Eaton and N. E. Rigler found that while maize is normally immune from *P. omnivorum* it is rapidly killed by the fungus when grown without its

normal complement of root-surface bacteria on sterilized sand-bentonite substrates. Heavily fruited cotton plants were more susceptible to *P. omnivorum* than were plants from which the bolls had been removed. Boll removal resulted in increased sugar concentrations in the roots and, in turn, in marked changes in the numbers of bacteria supported on the root surfaces. The acidity of certain Texas soils encourages the growth of micro-organisms destructive to the fungus. It grows poorly on acid Wilson soil as found in the field, but makes rapid growth following the addition of calcium carbonate (to neutralize acidity and so alter the microflora), or after steam sterilization, which destroys other organisms. Earlier workers have ascertained that the addition of manures and crop residues to soils encourages antibiotic organisms and reduces root rot [ibid., xxi, p. 137].

G. Ken Knight, A. L. Harrison, and A. A. Dunlap found that three applications of dusting sulphur increased the yield of 'hay' and groundnuts in one trial where *Cercospora* leaf spot [*C. personata* and *C. arachidicola*: ibid., xxii, p. 89; xxiii, p. 6] was severe in 1942. In one test, sulphur-copper dust was slightly more effective than sulphur used alone. Two applications of sulphur controlled rust (*Puccinia arachidis*) [ibid., xxi, p. 362]. In varietal tests marked differences in susceptibility to southern blight (*S. rolfsii*) [ibid., xxi, p. 361] were observed.

Botany and plant pathology section.—*Rep. Ia agric. Exp. Sta., 1943–44*, Part I, pp. 148–175, 19 figs., 1944.

This report [cf. *R.A.M.*, xxiii, p. 330] contains the following items of interest. As a result of breeding work by I. E. Melhus, C. S. Reddy, and C. Emans for resistance to melon wilt [*Fusarium bulbigenum* var. *niveum*] and anthracnose [*Colletotrichum lagenarium*] seed is to be produced from two new disease-resistant early strains, Early Resistant Queen and Black Kleckley, and from two hybrids, a Dixie Hybrid and a Kleckley Hybrid, the former moderately and the latter very resistant to wilt and anthracnose.

H. C. Murphy states that crown rust [*Puccinia coronata*] seems to have been the most important disease of oats in the humid area of the Upper Mississippi Valley in recent years. Next in importance was *Pythium* root necrosis [*P. debaryanum*: ibid., xxii, p. 383]. In areas of limited rainfall, loose and covered smuts [*Ustilago avenae* and *U. kolleri*, respectively] were more important than crown rust. During the period 1935 to 1943, all oat diseases caused an estimated reduction in yield in Iowa of 26·7 per cent. or an average loss of 13 bush. per acre.

Races 8 and 10 of stem rust [*Puccinia graminis avenae*] showed a phenomenal increase in distribution and prevalence in the Upper Mississippi Valley in 1943. The recently distributed varieties Boone, Control, Marion, Vicland, Tama, Vikota, and Cedar are susceptible to these two races.

Among 245 isolates from oat crown rust collections from the United States and Bermuda in 1943, 32 physiologic races were identified, 11 of which had not previously been recorded. Races 1 and 6 were again the most widespread and prevalent, and together made up over 50 per cent. of all the isolates. Relatively weak races, such as 2, 3, and 29, were again predominant in the New England area. The races present in Bermuda were very similar to those in the United States. In all, 82 physiologic races of crown rust have now been identified, using the 13 standard differential oat varieties. Either Bond or Victoria is resistant to each of the 82 races, or both are, with the exception of race 55 which has not been isolated from collections in North America.

Investigations were made by I. E. Melhus, J. N. Martin, and H. C. Murphy on the effect of seed treatment on soy-beans and the organisms causing root decay. The results of seed-treatment tests showed that stand was increased by some materials, though yield was not. *Pythium debaryanum*, *Rhizoctonia* sp., and *Fusarium* spp. were the organisms most frequently obtained from the roots. The

anthracnose organism (*Colletotrichum glycines*) and the pod and stem blight organism (*Diaporthe sojae*) were commonly obtained from rotting seed, though *Pythium* spp. and a soft rot bacterium were also isolated. *C. glycines* often caused severe neck rot at emergence.

A seed-treatment test for the control of the damping-off stage of potato black scurf (*Rhizoctonia* [*Corticium*] *solani*) by C. S. Reddy, E. L. Waldee, I. E. Melhus, and R. H. Porter showed that fermate (1-minute dip at 1 in 60), an organic mercurial (1-minute dip), and formaldehyde (cold, 2 hours) when used on certified Irish Cobbler seed reduced sprout lesions below the figure for the controls and for thiosan treatment. The number of healthy sprouts per tuber was greatest in the fermate, formaldehyde, and organic-mercurial series, while the best yields were given by formaldehyde and fermate.

The blight [*Phytophthora infestans*] resistance of 42 potato varieties and seedlings was compared by field observations, greenhouse tests of foliage inoculations, and laboratory tests using tuber inoculations. In the field, there were three groups of selections showing reduced susceptibility. The most resistant consisted of the *Solanum demissum* and *S. tuberosum* crosses TI–5 and AOB/4 and U.S.D.A. seedlings 528–229 and 627–216. Arnica was rather less resistant. The third group, which showed only slightly less infection than Irish Cobbler, etc., consisted of U.S.D.A. seedlings 528–170, 528–242, and 574–14, Hindenburg, and Sequoia.

In studies of the control of potato scab [*Actinomyces scabies*] in highly calcareous peat and muck soils by G. C. Kent, I. E. Melhus, W. J. Hooker, and A. T. Erwin, the use of sulphur as a soil amendment at the rate of 2,000 lb. per acre significantly lowered the incidence of the disease. The yield, however, was not significantly higher than those of the untreated controls. Tests of the effects of time and depth of ploughing on scab incidence showed that 'listing' to allow planting on undisturbed peat within the ploughed areas slightly reduced scab, as compared with the regularly planted area. Spring ploughing 10 in. deep definitely reduced incidence below that in the autumn-ploughed areas, whether ploughed 6 or 10 in. deep. The unploughed areas were intermediate. Seed treatments with cold formaldehyde, an organic mercurial, thiosan, and fermate gave no control.

G. C. Kent, I. J. Johnson, and C. P. Wilsie studied a disease of brome grass caused by *Xanthomonas translucens*, and characterized by small, water-soaked areas enlarging into yellowish, brownish, or blackish, somewhat translucent, irregular streaks on the leaves, culms, and young seedlings. Injury was greatest on the foliage. Inoculation tests showed that the organism also infected barley, wheat, rye, Erban oats, *Bromus catharticus*, *B. carinatus*, *B. erectus*, and *B. marginatus*. Three isolates from brome grass showed morphological, cultural, and physiological characters resembling those of the strains from wheat, barley, and rye. The brome pathogen overwintered in the foliage in the field and infected new leaves in the spring.

In the section of this report dealing with forestry (pp. 198–201), E. L. Wilson, G. B. MacDonald, C. J. Drake, and I. E. Melhus state that blister rust [*Cronartium ribicola*: ibid., xxiv, p. 296] was found in Iowa on native white pine in Dubuque County in 1934 and 1938 and on nursery stock in Lyon County in 1917 and in Story County in 1931; it has been found on *Ribes* in 33 counties or one-third of the State. Low temperatures with relatively high humidity are most favourable for the development of the disease. Locally, most of the infection appears to occur on *Ribes* in late summer and autumn; the disease occurred earlier and was more prevalent on *Ribes* in the spring of 1944 than in any previous spring. It seems that much of the infection on *Ribes* each year in Iowa is due to long-distance spread of spores by means of uredinial 'jumps' and aecidial 'showers' from pine-infection centres in Minnesota and Wisconsin.

Fifty-sixth Annual Report of the Vermont Agricultural Experiment Station for the year 1942–43.—*Bull. Vt agric. Exp. Sta.* 508, 37 pp., 4 figs., 1943. [Received June, 1945.]

This report [cf. *R.A.M.*, xxii, p. 239] contains, *inter alia*, the following items of phytopathological interest. R. R. Midgley and D. E. Dunkless found that cooked potatoes do not blacken [ibid., xxiii, pp. 40, 76] when commercial fertilizers are generously applied to soils which markedly fix certain plant food constituents. Grown on a soil which readily fixes potash and phosphorus, potatoes often become black and soggy after boiling if potash is not supplied in the fertilizer, assume a steel-grey colour if phosphorus has been omitted, and remain white and mealy if the soil is completely fed. Symptoms resembling leaf roll were produced when healthy potato seed was planted on phosphorus-hungry soil. Potato yields on a phosphorus-fixing soil were almost doubled when lime was freely applied, the crops remaining free from scab [*Actinomyces scabies*].

The same authors state that magnesium deficiency affected one large and several small potato crops during the period under review, only one-third of the yields being normal. Potato fertilizers sold in Vermont should contain soluble magnesium.

B. F. Lutman ascertained that scab lesions and browned spots apparently occur on the stems and roots as well as on the tubers. Cultures of soil organisms in a special pectin medium indicated that they seem to survive in the potato plant remains left as humus on the field and in the soil. The age of these humus particles was not determined, but inoculation with one-year-old humus gave positive results. All potato plants should be removed from fields to be replanted to this crop.

Laycock (D. H.). **Preliminary investigations into the function of the endotrophic mycorrhiza of Theobroma cacao L.**—*Trop. Agriculture, Trin.*, xxii, 4, pp. 77–80, 4 figs., 1945.

In this paper, written by W. T. Dale, but based on a dissertation by Laycock, a description is given of a Phycomycetous endotrophic mycorrhizal association in cacao roots from Trinidad, Tobago, and Yaguaraparo, Venezuela. As vesicles and arbuscules were rarely seen in these plants, the mycorrhiza are not classified as the 'vesicular-arbuscular' type [cf. *R.A.M.*, xxiii, p. 402], although such formations may have been prevented by some reaction in the cacao roots themselves. Efforts to isolate the fungus were unsuccessful.

Mycorrhizal density appears to be greater on 'bad' cacao plots than on 'good', but this does not indicate that the fungus is important in the nutrition of the cacao tree, and there was no evidence of parasitic behaviour.

A pot experiment showed that cacao seedlings can germinate and grow equally well either with or without mycorrhiza up to the age of 15 weeks at least. The fungus was found in garden soil in which cacao has not been grown in recent years, and may therefore live in the roots of other plants. It does not appear to be of any outstanding importance in the growth of cacao.

Bremer (H.) & Özkan (Mediha). **On cereal rusts in Turkey.**—*Zir. Derg.*, v, 59, pp. 5–12, 1944. [Turkish, with English and German summaries.]

Cereal rust (*Puccinia* spp.) epidemics are liable to occur in most parts of Turkey in years characterized by a wet spring and early summer. The last two years of this type were 1940 and 1943, the former of which was marked by outbreaks of stem [black] rust (*P. graminis*) [*R.A.M.*, xvii, p. 225] in all districts and of stripe [yellow] rust (*P. glumarum*) in some [ibid., xxiii, p. 336], while the latter was noteworthy for a fairly severe attack of yellow rust in the vicinity of Ankara.

P. graminis, the rust with the maximum heat requirements, cannot overwinter on cereals on the Central Anatolian plateau, and in view of the scarcity of bar-

berries the teleuto and aecidial stages are unlikely to contribute to the establishment of epidemics. The main source of inoculum is probably to be sought in the coastal regions, where conditions approximate to those known to permit of uredo hibernation, and whence spores could easily be conveyed by the wind. Heavy black rust infection is to be anticipated when heavy precipitation coincides with normal spring and summer temperatures.

P. glumarum, which needs less warmth than any of the other rusts [ibid., xxiv, p. 141], can certainly survive mild winters on the Central Anatolian plateau, where yellow rust epidemics are to be expected when a fairly cool, wet spring succeeds a mild winter, such as 1936. In 1943 the attack was rather lighter, notwithstanding favourable spring weather, owing to the rigorous preceding winter. In general, *P. glumarum* seems to predominate at high altitudes.

Of late years collections of wheat brown rust (*P. triticina*) and barley dwarf rust (*P. simplex*) [*P. anomala*] have been received only from the coastal districts, where they can overwinter in the uredo stage. Rye brown rust (*P. dispersa*) and crown rust of oats (*P. coronifera*) [*P. coronata*] are of merely local importance in view of the restricted areas of cultivation of their hosts.

Observations on the reactions of 40 wheat varieties to *P. glumarum* during the 1943 epidemic disclosed the existence of two highly resistant, two resistant, and three moderately resistant.

Becker (Hanna). **Arbeitsweise und Erfolge in der Weizenzüchtung an der Pflanzenzuchtstation der Universität Halle.** [Methods and results in Wheat-breeding at the Plant Breeding Station of Halle University.]—*Kühn-Arch.*, lx, pp. 369–401, 1 col. diag., 1944.

Among the objectives of the wheat-breeding programme at the Halle Plant Breeding Station, of which this is a fully tabulated survey and discussion, is the development of superior winter varieties combining hardiness with partial resistance to yellow, brown, and black rusts [*Puccinia glumarum*, *P. triticina*, and *P. graminis*], of high-yielding varieties resistant to yellow rust, and of strains from the abundant material collected by the German Hindu Kush expedition with sufficient resistance to mildew [*Erysiphe graminis*] to form the basis for further selection [cf. *R.A.M.*, xviii, p. 196 *et passim*].

The problem of breeding for resistance to yellow rust has long been in the foreground, but only at a later date could a comparable approach be made to the study of brown rust [ibid., xvii, p. 733], since no destructive epidemics of this disease occurred in Germany after 1905 and 1908 until 1930–32, inclusive. In the case of yellow rust, with its preference for low temperatures and capacity for infecting young stands in the autumn and during mild winters [ibid., xviii, p. 512; xxiv, p. 141], the main emphasis in breeding is laid on seedling resistance, whereas brown rust does not become widespread until June or July, and the adult stage is therefore the critical period for resistance. American summer wheats, notably Thatcher selections, are the most promising progenitors for the production of brown rust-resistant materials, while Chinese 165 and 166 [ibid., xiii, p. 620] and Ridit are used as parents in crosses directed towards the attainment of resistance to yellow rust. Resistance to black rust is not one of the most urgent aims, *P. graminis* having hitherto been of little importance in central Germany, but it assumed some prominence after the rigorous winter of 1941–2 and is in any case apt to be troublesome in the Alpine regions. Observations were therefore made from 1941 to 1943 at 20 branch stations in different parts of the country on the reactions of eight yellow rust-resistant selections to *P. graminis* as well as to *P. triticina*. Of these, two in particular promise to afford very valuable material for use as the starting points of new crossing operations, namely, 3496_{39} and 3312_{38} (both Thatcher × Kronen).

In the breeding of summer wheats, resistance to loose smut [*Ustilago tritici*], as well as to the yellow and brown rusts and mildew, must be taken into account. In connexion with the first-named, a difficulty has arisen in the recent recognition of a new physiologic race of South American origin in addition to the two already known [ibid., xi, p. 666]. The new race severely attacks certain selections of high or moderate resistance to the other two, e.g., Peragis × Marquis (3574_{28}), Peragis × Kinney × Grüne Dame (8885_{30}), Peragis × Hohenheimer 25f (3890_{30}), and Peragis × Heines Kolben (4185_{30}). A very promising variety, designated Breustedts Teutonenweizen (4453_{31}), is a product of Heines Kolben × R 1004. Its moderate resistance to race 3 of *U. tritici* is an obvious case of transgression, since both parents are more or less susceptible.

Attempts are in progress to combine resistance to the yellow and brown rusts and loose smut with attractive milling and baking qualities, hardiness, productivity, and other desirable features. Of the eight selections tested at different branch stations over a period of years, Ardito × 4185_{30} (3965_{39}) deserves special mention for its virtually complete resistance to *P. glumarum*; it is, however, inferior for baking purposes. The latter observation also applies to Varonne × 4185_{31} (5614_{38}), which is a desirable parent on account of its resistance to both rusts and to loose smut. Of the selections of superior quality, Thatcher × 4453_{31} (6645_{39}) is foremost in resistance to the rusts, while a similar response to loose smut is to be anticipated, though actual evidence to this effect is not yet forthcoming.

Three varieties are being used as parents in crosses aiming at the development of seedling resistance to mildew in summer wheats, viz., H.E. 516 (Hindu Kush), which has served as a partner to two Halle selections, 4453_{31} and 4172_{30}, *Triticum persicum*, and Greek 3. These varieties have withstood infection by all the physiologic races so far tested, including 1, 2, 3, 6, and one observed on Normandy in 1940 [ibid., xix, p. 206]. Breustedts Teutonenweizen is normally resistant to mildew in the field, but in 1940 it also succumbed to the 'Normandy' race, which has not, however, since reappeared, even in 1943, when the disease was prevalent.

Brentzel (W. E.). **The black point disease of Wheat.**—*Bull. N. Dak. agric. Exp. Sta.* 330, 14 pp., 2 figs., 1944.

The author describes experiments over a period of five years, 1938–43, into the effect of black point disease [*R.A.M.*, xxiii, p. 222] on several varieties of wheat in North Dakota. Red durum suffered worst, amber durum badly, and the hard wheats least severely, the principal agents responsible being *Alternaria* spp. and *Helminthosporium sativum* [ibid., xxiv, p. 221], the former causing the greater part of the discoloration and *H. sativum* doing most damage. Seed planted after infection with *H. sativum* showed considerably impaired stand and yield in 1943 and much root rot development. Seed infected with *Alternaria* spp. had greater weight than non-infected seed and their germination was not impaired, but seed infected by *H. sativum* regularly became shrivelled on any considerable penetration by the fungus. At the same time, 1942 was the only year in which *H. sativum* appeared as a seed-borne disease in an important amount. Planting seed infected with *Alternaria* spp., either alone or in close proximity to other seed, caused no noticeable development of disease and no reduction in stands of plants or yield. Disinfection of seed affected by *H. sativum* in 1943 resulted in a significant increase of yield, but no consistent betterment of yield has yet resulted from disinfection of seed affected by *Alternaria* black spot.

Mead (H. W.). **A biological method of detecting the presence of fungicides on seeds.**—*Sci. Agric.*, xxv, 7, pp. 458–460, 1 fig., 1945.

Observations having shown that the conidia of *Helminthosporium sativum* failed to germinate near wheat seeds dusted with ceresan, a method was devised in which

this principle was used to test seed for the presence of ceresan and to determine the percentage of seeds in any treated sample which had received a uniform covering of dust. Agar was poured into Petri dishes and inoculated with a suspension of the spores in water. The seeds (five per dish) were at once placed on the inoculated agar, and the plates were inoculated at 24° C. and examined about 48 hours later. It was then apparent that the fungus had failed to grow round the ceresan-treated seeds, while the untreated seeds were completely surrounded and in many cases overrun by mycelium. When the method was used to test coverage by a seed-treating machine or other means, samples were taken at timed intervals as the seed was being treated, about 20 seeds taken at random being tested from each sample.

The tabulated results showed wide variation in the efficiency of different dusting machines and methods, and some fluctuation in the amount of dust applied; with six different machines, for example, the percentages of seeds dusted (average for 10 samples) ranged from 64 to 100. Tabulated results are also given of tests by Miss A. M. Dickey to determine the inhibitive effect of ceresan and other fungicides on various fungi.

Ling (L.) & Li (T. K.). **The fungicidal efficiency of ferrous sulphate and its application as a seed disinfectant of Barley.**—*Chin. J. sci. Agric.*, i, 2, pp. 126–132, 1943. [Received June, 1945.]

In laboratory tests with ferrous sulphate recrystallized from the crude commercial product, the germination of the conidia of *Helminthosporium gramineum*, the agent of barley stripe, and of covered smut [*Ustilago hordei*], was completely arrested at a concentration of 1 per cent. Added to potato dextrose broth cultures at the rate of 0·5 per cent., the compound reduced the mycelial growth of *H. gramineum*, *Penicillium digitatum*, and *P. italicum* by about 60 per cent. as compared with the controls; at 1 per cent. it entirely inhibited the development of the first-named organism.

In field experiments in 1937, the incidence of stripe was reduced from 12·5 to 2·8 per cent. by eight hours' immersion of the barley seed-grain in a 2 per cent. ferrous sulphate solution, while in 1938 the same treatment for 8 to 16 hours at 1 to 3 per cent. resulted in a nearly clean crop, compared with 10·9 per cent. in the control plots. No injury to the seed was caused by the longer period of immersion at concentrations of up to 5 per cent. Four hours' immersion in 5 per cent. ferrous sulphate reduced the amount of infection by *U. hordei* from 10 to 1·4 per cent., a result roughly comparable to that secured by treatment with copper sulphate or formalin but less satisfactory than that given by the organic mercury dusts. Tested against wheat flag smut (*Urocystis tritici*), ferrous sulphate reduced the incidence of infection from 41·3 to 5·6 per cent., but its action on this pathogen is not equal to that of the standard treatments with copper sulphate, formalin, hot water, and mercury dusts.

Ziegenbein (Gerta). **Arbeitsweise und Erfolge in der Hafer- und Gerstenzüchtung an der Pflanzenzuchtstation der Universität Halle.** [Methods and results in Oats and Barley breeding at the Plant Breeding Station of Halle University.] —*Kühn-Arch.*, lx, pp. 440–454, 1 diag., 1944.

For the last 15 years work has been in progress at the Halle Plant Breeding Station on the development of resistance to loose smut [*Ustilago avenae*: *R.A.M.*, xiii, p. 364] in oats. Particularly encouraging results have been secured with crosses having Black Mesdag as one of the parents: in 1943 two resistant selections were due for their final trials by the Reich Food Board, while a further five were still undergoing tests for eligibility. To attain this end some 40,000 seeds of a hybrid population were annually inoculated with a mixture of physiologic races

of loose smut and the non-infected plants set aside. The next year the seed-grain was divided into two lots, one for reinoculation and the other sown in a special plot for observations on the characters of the progeny of individual healthy plants. The appraisal of yielding capacity and other properties of the selected offspring was effected in the following year in immature plots. At the same time a third inoculation was performed. Only after three years' freedom from infection under these conditions is a selection adjudged to be resistant.

There is a wide gulf between the Hindu Kush summer barleys serving as progenitors in crosses directed towards loose smut (*U. nuda*) and stripe disease (*Helminthosporium gramineum*) resistance and the prolific winter-hardy varieties required for Central European conditions. The recent severe winters have necessitated special attention to the development of hardiness, and some selections are already available combining this attribute of the Mahndorfer parent with several years' freedom from one or both diseases, four of which in 1943 approached or surpassed the standard varieties, Mahndorfer and Friedrichswerther, in productivity, viz., 55/22, a derivative of Goldth[orpe]×Haya Rokkaku (I_F 2349×50/41), Friedrichswerther×Mie (I_F 2206–10/41), Kalkreuther×Nepal (I_H 3054–59/41), and 41/22 (descended from Goldthorpe)×Chinko (I_F 3235–54/41).

Promising results have also been obtained in breeding for resistance to mildew [*Erysiphe graminis*: ibid., xx, p. 251; xxiii, p. 11], notably in the case of selection 638_{40}, an exceptionally hardy product of the cross 40_{30} (27_{21}×Friedrichswerther)×Ragusa 416, the yield of which exceeded that of Mahndorfer in 1943.

In the case of summer barleys, resistance to loose smut and stripe disease has not yet been satisfactorily combined with productivity, but further attempts are in progress to develop these and other desirable qualities, such as smooth awnedness, in crosses between Nepal and certain Japanese types and German or American varieties. According to Freisleben (*Kühn-Arch.*, liv, p. 295, 1940), two of the Hindu Kush barleys unite freedom from mildew (physiologic races A to E), loose smut, and stripe disease, and these have been crossed with high-yielding varieties and selections and back-crossed in the F_1 with the prolific parent. Further observations on the progeny of this material are planned.

Newton (Margaret) & Johnson (T.). **Physiologic specialisation of Oat stem rust in Canada. I.**—*Canad. J. Res.*, Sect. C, xxii, 10, pp. 201–216, 1 diag., 1 graph, 1944.

Annual surveys of the prevalence of the different physiologic races of oat stem rust (*Puccinia graminis avenae*) carried out in Canada since 1921 have shown that races 1, 2, and 5 comprised the bulk of the isolates, 12 races being identified in all up to the end of 1943. The predominance of races 1, 2, and 5 has been greatest in the Prairie Provinces, where barberry is practically non-existent, and may be related to the fact that these races produce teleutospores later and so continue to yield uredospores for a longer time. In regions where barberry is present other races of greater range of pathogenicity have been found more frequently. The occurrence of such races was, however, only sporadic until 1943, when races 8, 10, and 11 were widely distributed, apparently owing to uredospores blown in from the south. The isolates of races 8, 10, and 11 collected in 1943 differ from those of earlier years in showing a pronounced delay in teleutospore formation. An analytical key is given for the differentiation of the races of the rust, using the varieties White Tartar, Richland, and Sevenothree, and a table supplied of the infection types produced on seedling leaves of these.

The effect of environment on the behaviour and therefore the ease of identification of physiologic races is shown in a table by the seasonal influences of the reaction of Sevenothree to races 1 and 11. On this variety the characteristic type 1 reaction is often replaced in summer by type X. It is also shown that, although adult White Tartar and Richland remained resistant when exposed to

a temperature of about 80° F., the resistance of some Hayira crosses broke down under the same conditions. The possibility of the spontaneous appearance of another race is also discussed. In some cases the power to produce a heavy type of infection is recessive and it may be possible that the crossing of two races between types, neither strongly infective, might produce a highly infective race. For example, it has been found that race 8 which attacks White Tartar only weakly may produce aecidiospores on barberry which eventually give rise to uredospores of race 6 which attack White Tartar heavily. The possibility of mutations occurring is of importance, but unless the mutation occurs repeatedly it is difficult to distinguish it from contamination with another race. The authors describe experiments in which race 7 appeared to arise spontaneously and repeatedly from race 3. The possibility of future changes in the pathogenicity of the rust necessitates an adequate annual survey of physiologic races and further development of rust-resisting varieties of the oat.

Koch (L. W.) & Murwin (H. F.). **The Hybrid Corn industry in Ontario: pathological and other problems.**—*Emp. J. exp. Agric.*, xiii, 50, pp. 100–111, 3 pl., 1 map, 1945.

During recent years approximately 75 per cent. of the total acreage of maize in Canada has been concentrated in Ontario, where the open-pollinated varieties in use before 1939 have been almost completely replaced by hybrids to meet the increasing demand for hybrid varieties suited to Canadian conditions. A large-scale breeding programme was initiated at the Harrow Dominion Experimental Station and, since the loss from disease is a factor of economic importance, it was realized that pathological studies must of necessity be integrated with the breeding programme. Hybrids, unlike open-pollinated varieties, are either uniformly susceptible or uniformly resistant to disease.

Generally speaking, seedling diseases, caused by species of *Pythium*, *Helminthosporium*, and *Fusarium* [*R.A.M.*, xxi, p. 448], are the most important maize diseases in Ontario, where surveys have shown ear and stalk rots caused by *Diplodia zeae* (the most virulent pathogen), *Fusarium moniliforme* [*Gibberella fujikuroi*], *G. zeae*, and *Nigrospora sphaerica* (the least virulent) to be destructive. Rust (*Puccinia sorghi*) and smut (*Ustilago maydis*) also occur.

The technique finally adopted for testing resistance to ear and stalk rots consisted in puncturing an internode about 1 ft. above ground-level with a blunt wire and interjecting 10 c.c. of a spore and mycelial suspension of the pathogen, series of inoculations being made in July, mid-August (at the early silking stage), and in September (milk stage). In the third series, *D. zeae* consistently caused up to five times more injury after two weeks than in either of the earlier series.

The paper gives brief accounts of the above diseases and includes a list of hybrids recommended for use in Ontario, which show considerable resistance to disease, lodging, and corn-borer attack.

Stevens (N. E.). **Distribution of Diplodia zeae and D. macrospora in the United States.**—*Trans. Ill. Acad. Sci.*, xxxvi, 2, pp. 107–108, 1 map, 1943. [Received June, 1945.]

Two apparently closely related species of *Diplodia* are responsible for ear rots of maize in the United States, namely, *D. zeae*, first reported in 1822, and *D. macrospora*, originally described in 1897 [*R.A.M.*, xxi, p. 285]. In culture the latter fungus appears to be decidedly inferior to the former, having a narrower temperature range, sporulating less freely, and depending on external sources for the biotin essential to its growth [ibid., xvi, p. 245]. Moreover, in the United States, at any rate, the geographical range of *D. macrospora* is more limited than that of *D. zeae*. The latter has been reported from California and every State east

of the Rocky Mountains except the three northern New England States, whereas the former, apart from one record in Connecticut and two in Delaware, has been notified only from the south-eastern States.

During February and March, 1943, the author collected material of both species in Tennessee, Mississippi, Louisiana, Texas, and Oklahoma, and the results have been combined with previous observations by himself and others, covering a period of several years, to give the following figures: Alabama 425 collections, Florida 975, Georgia 175, Kentucky 254, Louisiana 79, Mississippi 233, Oklahoma 157, South Carolina 123, Tennessee 1,148, and Texas 60 [cf. ibid., xviii, p. 17].

Slagg (C. M.), Livingston (J. E.), & Swinbank (J. C.). **Moisture content and development of molds in Corn stored under various conditions in three eastern Nebraska counties during the winter of 1944–45.**—*Plant Dis. Reptr*, xxix, 11, pp. 282–285, 1945. [Mimeographed.]

A considerable part of the record crop of 329,855,000 bush. maize in Nebraska in 1944 had to be stored in temporary cribs and in piles on the ground. Early winter-marketing of temporarily stored maize was impossible owing to the size of the crop interfering with shelling and the lack of transport, and an unusually wet winter, encouraging mould, led to serious losses.

The senior author found that deterioration was evident in February in some permanent cribs as well as in temporary cribs and piles in the open, but maize in some piles on the ground without protection of any kind was found in good condition. Maize damp or not fully ripened at the time of cribbing was found to be still wet in the centre of the crib in mid-March, 1945, regardless of the type of crib, and maize which was dry at cribbing still had a low moisture content. Mould development was highest in maize carrying a high moisture content when cribbed and regardless of the type of crib. The general conclusion reached was that the winter of 1944–5 in Nebraska was not conducive to drying of ear maize in cribs. Maize with less than 21 per cent. moisture when cribbed kept satisfactorily, while 27 per cent. moisture exposed grain to mould attack. Some drying was observed in the outer portions of cribs in maize stored with a moisture content above 27 per cent. The drier samples from such cribs contained about 24 per cent. moisture.

Gowen (J. W.). **Genetic aspects of virulence in bacteria and viruses.**—*Ann. Mo. bot. Gdn*, xxxii, 2, pp. 187–211, 6 figs., 1945.

The author expresses the view that disease is caused by the interaction of four major variables: the genetic constitution of the host for disease susceptibility or resistance, of the pathogen for virulence or avirulence, the dose to which the host is exposed, and the many variables conventionally classed as environmental effects.

In the course of the work reviewed in this paper two different lines of the maize-wilt organism (*Phytomonas* [*Xanthomonas*] *stewarti*) [*R.A.M.*, xxi, p. 523] were examined for phenotypical variants in the original pure stock and for mutations occurring naturally and after irradiation with X-rays. One of these lines, a dark yellow, rough type with medium-sized colony, showed three progeny mutants below and nine above the parent's rather low virulence index of 31. When the original parent stock is rather low in virulence, a mutant is frequently more virulent in type. The indexes ranged up to 70 with an average of 45. Seven of nine mutants of the second line, a large colony with a diffuse centre, showed indexes below that of the parent (index 75) and two had indexes above (81 and 78), the average virulence being 62. The author cites the results of Holmes's studies on mutations derived respectively from a masked and a distorting strain of tobacco virus [ibid., xvi, p. 129], which agree with his experiments on *X. stewarti* in showing a persistence of virulence type even with marked changes in other characteristics.

Pathology and mycology of Corn.—*Rep. Ia agric. Exp. Sta., 1943–44*, Part II, pp. 62–66, [? 1945.]

In this report [cf. *R.A.M.*, xxiii, p. 331] R. H. Porter and W. N. Rice state (p. 38) that during the period under review *Fusarium graminearum* [*Gibberella zeae*], and species of *Helminthosporium*, *Curvularia*, and *Epicoccum* were isolated from seed of sorghum, oats, and timothy [*Phleum pratense*] in Iowa. The pathogenicity of these isolates is being investigated.

A test was made of the germination of seed of eight varieties of spinach (untreated, and treated with arasan, fermate, and zinc oxide) in sterilized sand at 10° C., in *Pythium*-infested soil at 10°, and in the field. In sterile sand the germinability of the untreated seeds ranged from 88 to 97 per cent., and that of the arasan, fermate, and zinc oxide-treated seeds from 91 to 97, 88 to 98, and 87 to 98 per cent., respectively; in the infested soil the corresponding figures were 23·5 to 78, 70 to 87·5, 42·5 to 77·5, and 67·7 to 88·5 per cent.; while in the field they were 25·2 to 48·4, 41·6 to 64, 43·4 to 60·6, and 48·6 to 56·4 per cent. When 17 lots (five varieties) of sweet corn seed treated with arasan, barbak DX, untreated, and treated with spergon were grown in *Pythium*-infested soil for seven days at 10°, the germination ranged from 65 to 93·5, 9·8 to 72·3, 9·3 to 65·5, and 54·8 to 88·8 per cent., respectively. In general, seed dried in the ear offered more resistance to *Pythium* at 10° in this test than did seed combined before drying. In other similar tests against *Pythium*, arasan and zinc oxide gave better protection to spinach seed than did fermate, while arasan and spergon were far better than barbak DX as a protectant for sweet corn seed.

I. E. Melhus and G. C. Kent (p. 62) state that further improvement was made in methods of testing maize for reaction to *Ustilago zeae* [*U. maydis*] in the seedling stage [ibid., xxiii, p. 332] by inoculating before emergence. The seeds were sprouted on moist blotters, and then inoculated hypodermically with a matched pair of sporidia in carrot decoction. The sporidial suspension was injected directly into the growing point on the cotyledonary node. The seedlings were then transplanted into sand in flats in the greenhouse or grown on blotters under bell jars in the laboratory. The percentage of infection obtained decreased as the coleoptiles were allowed to grow further before injection. Maize seed soaked in water for 48 hours and inoculated before emergence of the coleoptile gave a very high percentage of infection. Seedlings inoculated when the coleoptile had extended $\frac{1}{4}$ to $\frac{1}{2}$ cm. out from the seed coat usually developed definite galling in three days. Records were made after seven days, when all the symptoms were in evidence. All the varieties tested, including strains from Mexico and crosses from these on to Corn Belt inbreds, showed a uniformly high percentage of infection.

G. Semeniuk, C. S. Reddy, I. E. Melhus, W. E. Loomis, E. W. Lindstrom, and G. F. Sprague (p. 62) studied the disease incidence in the field on the mesocotyls and primary roots of maize plants about $2\frac{1}{2}$ ft. high raised from seed of Illinois Hybrid 960 and a composite mixture of ten commercially grown hybrids. The seeds were planted on five different dates, beginning on 22nd April, 1943, and continuing at ten-day intervals.

Disease development was worse with each successive planting. Incidence was higher on the mixed hybrids than on Illinois Hybrid 960. Benefits from seed treatments in disease reduction were noted at all planting dates, though not all the benefits were significant. Reductions of disease on primary roots were less frequent, occurring chiefly in the two earliest plantings. Semesan jr. gave the best results of the materials tested in reducing disease on the mesocotyls, while spergon and arasan came next. Semesan jr. gave some reduction of disease on the primary roots. Isolations from the diseased mesocotyl tissues from the first, third, fourth, and fifth plantings yielded predominantly *Fusarium moniliforme* [*G. fujikuroi*],

alone or together with *Trichoderma* sp. and with or without an unidentified chlamydospore-producing organism found abundantly on the roots. Diseased primary roots from the first- and last-planted plots gave chiefly *Helminthosporium* sp. and *G. fujikuroi*, while those from the third and fourth dates-of-planting plots gave mostly an unidentified chlamydospore-producing organism, followed by *Helminthosporium* sp. and *G. fujikuroi*. All three organisms were usually found in association, with *Helminthosporium* dominant.

Bliss (D. E.). **Controlling Armillaria root rot in Citrus.**—*Calif. Citrogr.*, xxx, 5, pp. 130–131, 154–155, 7 figs., 1945.

This is a verbatim presentation of a report which has been previously noticed [*R.A.M.*, xxiv, p. 225].

Chapman (H. D.), Brown (S. M.), & Rayner (D. S.). **Nutrient deficiencies of Citrus.**—*Calif. Citrogr.*, xxx, 6, pp. 162–163; 7, pp. 198–199, 216 217; 8, pp. 230–231, 246–248; 11 figs., 1945.

In the first of this series of articles on the symptoms, causes, and control of mineral deficiencies of citrus, the authors describe in outline the nature of the mineral element requirements of citrus [see next abstract] and discuss iron chlorosis [cf. *R.A.M.*, xx, p. 461]. The second paper deals with deficiencies of manganese, zinc, and copper, and the third and final with those of nitrogen, phosphorus, and sulphur.

Chapman (H. D.) & Kelley (W. P.). **The mineral nutrition of Citrus.** *Ex* **The Citrus industry Volume I: history, botany, and breeding. First edition.**—pp. 719–766, 3 col. pl., 18 figs., University of California Press, 1943. [Received June, 1945.]

The chapter (VII) contributed by the writers to the book with the above-mentioned title by H. J. Webber and E. D. Batchelor comprises, *inter alia*, a discussion of the mineral composition of citrus and its plant-food requirements [see preceding abstract], with special emphasis on the effects of deficiencies and excesses [*R.A.M.*, xxiii, p. 386].

Bertelli (J. C.) & Bertelli (Lucia K. De). **Notas fitopatológicas. Estudio etiológico de la 'podredumbre de las raicillas' o 'tristeza' de los Citros.** [Phytopathological notes. An etiological study of the 'root rot' or 'tristeza' of Citrus.]—*Rev. Asoc. Ing. Agrón.*, xvii, 1, pp. 15–32, 8 pl., 1945. [English summary.]

Pursuing their studies on citrus root rot ('tristeza') in Salto, Uruguay [*R.A.M.*, xxiv, p. 98], the writers observed the associated species of *Lasiodiplodia* or *Botryodiplodia* on adult mandarin and sweet orange trees grafted on sour orange stocks. Its penetration was effected exclusively through lesions in the woody tissues of enfeebled sweet and sour orange trees. The possibility is envisaged of a causal connexion between the fungus and the death of the trees from exhaustion consequent on vascular obstruction and depletion of the starchy reserves in the union zone of scion and stock. These features of the symptomatology of the disease differ from those previously described in connexion with 'tristeza'.

A virus thought to be possibly identical with that of the type of psorosis found in Corrientes, Argentina, was detected in the foliage of diseased sweet orange trees grafted on sour stocks; of four to five-year-old sour oranges, attempts at the grafting of which were unsuccessful; of recovering nursery mandarins grafted on sour stocks; and of healthy sweet oranges grafted on stocks of the same species. Normally latent, the virus assumes a pathogenic habit in the sweet orange scion-sour orange stock combination.

Martyn (E. B.). **Coconut diseases in Jamaica. (1) Bronze leaf wilt and other diseases affecting the bud of Coconuts. (2) Diseases affecting the leaves, crown and stem of Coconuts.**—*Trop. Agriculture, Trin.*, xxii, 3, pp. 51–59; 4, pp. 69–76, 3 figs., 1 map, 1945.

Following an outline of coco-nut cultivation in Jamaica the author classifies the coco-nut diseases present as follows: (i) those causing rapid death of the bud: bronze leaf wilt [*R.A.M.*, xxi, p. 242; xxii, p. 237], bud rot (*Phytopthora palmivora*) [ibid., xx, p. 200], and lightning strike: (ii) diseases affecting the emerging leaves, usually without killing the bud: bitten leaf [ibid., xxii, p. 197] and St. Mary disease: (iii) diseases affecting the appearance of the whole crown or of the outer leaves, but not causing the death of the palm immediately: leaf spots, drought wilt, leaf-break, yellowing, little leaf, and false wilt; (iv) diseases of the stem: stem-bleeding and leaf-scar disease.

Bronze leaf, although present in small areas, is the most serious of the coco-nut diseases of Jamaica and has entirely destroyed many of the plantations along the almost continuous belt of coco-nuts between Montego Bay and Lance's Bay. The disease has apparently not yet been recognized outside the Caribbean region. Local observations throw doubt on the theory that bronze leaf is a non-parasitic wilt, and therefore, pending a true diagnosis, it should be regarded as infectious, and diseased trees should be cut down and their crowns burnt. The disease does not appear to be a true wilt, in so far as that term denotes a condition brought about by lack of water [ibid., xx, p. 112]. An examination of the symptoms at various stages suggests that the causal factors initiate a breakdown of the tissues in the young flowering parts and growing leaves, which fall a prey to saprophytic bacteria, multiplying rapidly and setting up the ill-smelling rot which eventually assails the heart. Attempts to reproduce the disease artificially by inoculation with bacteria taken from the dying heart have failed. The disease affects palms of all ages, on different soils and in both wet and dry seasons, and may cause a mortality of 90 per cent. on 30-year-old plantations, a behaviour scarcely to be attributed to a non-parasitic agency. At the same time, the tendency of the disease to spread in the direction of the prevailing wind may be compatible with a virus origin, with an air-borne vector.

P. palmivora also attacks palms of all ages, particularly under very humid conditions and after hurricanes, when it is not always practical to apply prophylactic measures. It is not easy to detect in the early stages and may pass unnoticed until the sudden collapse of the outer leaves.

Palms killed by lightning show a collapsed crown and exudation from the stem, which is soon attacked by boring insects. The trees should be cut down, burnt, and replaced.

The remaining diseases of coco-nuts in Jamaica, apart from false wilt, which is of genetical origin, are all attributable to environment, and a suitable choice of planting sites will prevent their doing serious damage. The genus *Phytophthora* can be definitely associated with some of them, although in most cases only as secondary invaders of tissues already weakened by other causes. Symptoms such as internal lesions of the trunk and mid-ribs, withering of the inflorescences, an unhealthy appearance of the endosperm, or a partial shedding of nuts, may be found associated with palms in the unthrifty conditions related to St. Mary disease. In all these cases, however, palms can be restored to health with suitable treatment.

In the case of bitten leaf, lesions caused by experimental manipulation of the heart have been found infected with *Thielaviopsis* [*Ceratostomella*] *paradoxa*. This is not, in the author's view, a primary cause of any form of bitten leaf, but the symptoms reproduced are entirely comparable with the 'hard' and 'pineapple-leaf' types of bitten disease ascribed to *C. paradoxa*. He agrees with Briton-Jones

[loc. cit.] that *P. palmivora* may often cause the subsequent appearance of bitten leaf, which may also be aggravated by beetles or other insects. Rain trickling down the leaves and wetting the inside of the central column and the heart tissues below encourages primary or secondary fungal attack on tissues mechanically damaged or previously parasitized. Sometimes *C. paradoxa* is present in a secondary role, while at others the damaged tissues react by a type of gum formation that inhibits fungi. When the final symptoms are observed, however, it is not always possible to determine the original cause with certainty. In normal years the rarity of the disease results in its often being overlooked. Sometimes natural recovery takes place, and sometimes the bud is affected and death results. Excision of all diseased tissues and treatment of the remainder of the heart with a fungicide is the generally accepted remedy.

Apropos of St. Mary disease, the author observes that he has seen several diseases of the maturing leaves with symptoms similar to those described by Smith [ibid., xii, p. 90]—brown and sometimes ashen discoloration of the pinnae with gum oozing from slight lesions. The symptoms are found in areas of high rainfall or after an abnormally wet season, and are associated with soils unsuitable for coco-nut-growing or temporarily sodden by heavy rain.

Stem diseases are unimportant, and no definite root diseases of the coco-nut palm in Jamaica are known to be caused by any fungus. Several diseases are clearly related to soil conditions. There is much to be discovered as to the exact relationship between the various unhealthy symptoms shown by the leaves, the fall or otherwise in the yield of the nuts, and the soil conditions responsible. Phosphate deficiency, for example, is apparently correlated with marked chlorosis of the leaves, and may in other cases cause a reduction in or even the absence of nuts on palms otherwise healthy.

A key to the diseases of coco-nut palms in Jamaica is appended together with bibliographical references.

Orian (G.). **Bud rot of the Royal Palm in Mauritius caused by Bacterium vasculorum (Cobb) Greig Smith. (A preliminary report.)**—*Rev. agric. Maurice*, xxiv, 2, pp. 85–86, 1945.

From bud rot of royal palm (*Roystonea regia*) in Mauritius the author isolated an organism morphologically and physiologically identical with *Bacterium* [*Xanthomonas*] *vasculorum*, and inoculations with the isolate into sugar-cane, maize, and *Thysanolaena maxima* [*T. agrostis* Rees: *R.A.M.* xx, p. 381] gave stripes characteristic of the sugar-cane pathogen. It is, therefore, concluded that bud rot of royal palm in Mauritius is caused by *X. vasculorum*, and that a new host of sugar-cane gumming disease has been discovered in the island.

Thorold (C. A.). **Elgon dieback disease of Coffee.**—*E. Afr. agric. J.*, x, 4, pp. 198–206, 2 figs., 1945.

Studies on Elgon die-back of coffee [*R.A.M.*, xvi, p. 796; xviii, p. 438] in Kenya showed that in its mildest form it is little more than a severe case of the 'black tip' appearance associated with 'hot and cold' disease. It is typical of Elgon die-back to find a blackening at the base of the large leaves, as well as at the tip of the stem or branch, as in 'hot and cold'. At the other extreme, the disease resembles the death of branches from over-bearing or loss of leaf. The main difference is that in Elgon die-back a few leaves remain, usually at the tip of the branch, when the condition is first noticed. In ordinary die-back, the branch dies only when almost bare.

Fungi isolated from diseased material, including *Phoma* sp. and *Colletotrichum coffeanum* [*Glomerella cingulata*: cf. ibid., xv, p. 214], were used to inoculate healthy stems, but in no case did the disease result, and it was concluded that such fungi

were secondary organisms. The removal of affected shoots was not effective as a means of control.

Both Elgon die-back and 'hot and cold' were amenable to shade, whether artificial or natural, and it was also found that the bronze-tip and broad-leaf type of coffee is resistant to both disorders. Differences in manner of growth between shaded and unshaded trees were found to correspond with similar differences between resistant and susceptible trees when grown without shade. The condition generally developed in stems where premature leaf-shedding had occurred, and it was also produced by artificial defoliation.

In the author's opinion Elgon die-back and 'hot and cold' are causally associated with carbohydrate deficiencies occurring, under the local soil conditions, where coffee is grown without shade.

Susceptible-type trees in a plantation can be rendered resistant by grafting on to them scions from bronze-tip and broad-leaf trees, or by approach grafting with seedlings of such trees—an operation that can be carried out by natives after short training. The best way to control Elgon die-back and 'hot and cold' is to establish shade trees. *Entada abyssinica* is recommended for this purpose and it is desirable when a new variety is to be planted to use some type of coffee known to produce good-quality beans, e.g., Blue Mountain, which is resistant to coffee berry disease [*G. cingulata*: ibid., vi, p. 78; xviii, pp. 21, 519].

In a footnote by S. G[illett] appended to this paper it is stated that areas of the resistant type of coffee (bronze-tip, broad-leaf) on exposed sites have recently succumbed to Elgon die-back. Windbreaks should be planted on all such exposed areas. Also, Blue Mountain does not produce economic crops under heavy shade. Where Elgon die-back and berry disease are present, this variety should be planted, but with a very light canopy of shade.

Lehman (S. G.). **Treat Cotton seed.**—*Res. & Fmg*, iii, *Progr. Rep.* 3, p. 5, 1 fig., 1945.

Germination and disease tests on several lots of cotton seed grown in eastern North Carolina in 1944 showed that half or more of the seeds of each carried anthracnose [*Glomerella gossypii*] spores. A considerable amount of seed may be saved by treatment with new improved ceresan at the rate of 1 to 1½ oz. per bush., costing 5 to 8 cents per bush. In a number of tests on seed of 85 to 90 per cent. germination, planting five treated seeds per hill in hills spaced 12 in. apart (2½ pecks per acre) produced adequate stands for maximum yields, whereas many growers have thought it necessary to plant 10 to 12 seeds per ft. to secure comparable results with untreated material. Directions are given for a simple method of dusting in a barrel or drum.

Thomas (K. M.), Ramakrishnan (T. S.), & Srinivasan (K. V.). **The natural occurrence of ergot in South India.** *Proc. Indian Acad. Sci.*, xxi, 2, pp. 93-100, 1 pl., 7 figs., 1945.

The successful production of rye ergot at the Agricultural Research Station, Nanjanad, Nilgiris, in 1941–2, encouraged the expansion of the scheme, in connexion with which a survey was conducted on the Nilgiri plateau, parts of Wynaad and Kodaikanal (Malabar), and Anamalais (Coimbatore) for indigenous species of *Claviceps*. Eighteen grasses were found to be infected, of which 15 are new records, the sphacelial and sclerotial stages being present on 12, while only the former occurred on the remainder [cf. *R.A.M.*, xxiv, p. 234]. The fungi were tentatively classified in four groups on the basis of their conidial characters, viz., (1) curved or fusoid conidia, sclerotia formed, (*a*) smaller conidia (10·9 to 17·6 by 4·6 μ), whitish honeydew, (*b*) larger conidia (20·4 by 8·8), dark honeydew; (2) mostly triangular conidia, 10·4 to 14·6 by 4·9 to 6·6 μ, sclerotia usually formed;

(3) presumably representing *C. purpurea*, oval or round conidia, 4 to 7·4 by 2 to 3·9 μ, sclerotia developed; (4) oblong conidia, 8·7 to 13 by 4·4 to 5·8 μ, sphacelial stage only. The hosts of group (1*a*) are *Cynodon dactylon* [ibid., xxiv, p. 104], *Urochloa reptans*, *Digitaria chinensis*, and *Apluda aristata*; of (1*b*), *Pennisetum hohenackeri* (*P. alopecuros*) [ibid., vi, p. 91]; of (2), *Chrysopogon zeylanicus*, *Heteropogon contortus*, and *Cymbopogon polyneuros*; of (3), *Brachypodium sylvaticum*, *Oplismenus compositus* [ibid., xxiii, p. 65], *Agrostis pilosula*, *Amphilophis foulkesii*, *A. insculpta*, and *Thaneda quadrivalvis*; and of (4), *T. triandra*, *Ischaemum aristatum*, *Andropogon lividus*, and *C. flexuosus*.

Forsyth (D. D.) & Vogel (O. A.). **Effect of seed coat injuries during threshing on emergence of Flax seedlings.** *J. Amer. Soc. Agron.*, xxxvii, 5, pp. 387–393, 1945.

Two important causes of the annual variation in the initial stands of flax obtained at the Washington Agricultural Experiment Station were found to be mechanical damage to the seed, mainly from machine threshing, and the presence of soil-borne organisms, principally *Fusarium oxysporum*. The problem of poor emergence was less acute in the soils from five other localities in the State on which tests were performed than at Pullman, where agents of seed decay and pre-emergence damping-off appear to be exceptionally prevalent.

Colhoun (J.). **The prevention of seed-borne diseases of Flax. III. The dusting, short wet, and fixation methods of seed disinfection in relation to storage of the seed.**—*Ann. appl. Biol.*, xxxii, 1, pp. 34–37, 5 graphs, 1945.

To determine the effect of the dusting, short wet, and fixation methods of disinfecting flax seed [cf. *R.A.M.*, xxiv, p. 191] upon the germination of stored seed, the author carried out an experiment in which Liral Crown seed with a moisture content of 7·2 per cent. was subjected in lots of 1 cwt. to the following treatments: nomersan 12 oz., ceresan U 564, 4 per cent., 0·9 gal., same at 8 per cent., 0·45 and 0·9 gal., and ceresan 1875 A 12 oz. fixed with separated milk, 0·9 gal. One lot of seed remained untreated, as control. The seed was bagged immediately after treatment, except that with the short wet or fixation method the sacks were sewn up two hours after treatment. The results showed that the moisture content of the seeds immediately after treatment was, respectively, 7·2, 13·8, 10·6, 14, 13·5, and that of the control 7·2 per cent., while the germination after 14 months' storage was, respectively, 98, 97, 92, 78, 89, and 95 per cent.

Since 1940, all the sowing flax seed produced in Northern Ireland has been treated with nomersan by the dusting method and in no case has viability been reduced during storage for 18 months after treatment.

In a second experiment, 1 cwt. lots of Liral Dominion seed from the same crop containing, respectively, 5·8, 8·7, 10·4, 11·8, and 13·2 per cent. moisture were treated with ceresan U 564 (8 per cent., 0·9 and 0·67 gal.), and ceresan U.T. 1875 A (12 oz. fixed with 0·9 gal. separated milk), one sample from each lot being left untreated. The results showed that after about six months in commercial storage the moisture content of each lot, irrespective of treatment and of the initial moisture content, became stabilized at about 10 to 12 per cent. The untreated seed at all the moisture contents used continued to germinate well after 13 months in storage, though after a further 12 months' germination was in most cases low. In general, treatment reduced viability in storage, and the higher the moisture content was before treatment, the sooner this effect became apparent. Seed with an initial moisture content of 5·8 per cent. treated with ceresan U 564 did not show any serious reduction in germination until after about six months' storage.

In both 1943 and 1944, about 10 tons of seed was disinfected by the short wet method, using ceresan U 564 (8 per cent. at 0·67 gal. per cwt.), the moisture

content before treatment being between 5 and 6 per cent. The seed was mostly sown about three months after treatment, and no ill effects on the crop were observed, but one bag, stored for 12 months, showed 76 per cent. germination, as against an initial value of 95 per cent.

Millikan (C. R.). **Iron deficiency chlorosis of Flax.**—*J. Dep. Agric. Vict.*, xliii, 3, pp. 133–134, 1 fig., 1945.

During 1943, flax at Westmere, Victoria, developed a condition in which the new leaves were yellow to white; subsequent growth was very retarded, and the tops of the plants assumed a rosetted appearance, resulting from the shortening of the internodes between the leaves. Many plants died, leaving large bare patches in the crop, and the remainder did not make much growth. In October, the surviving plants began to recover, apparently with the onset of warmer, drier weather, and finally reached a height of about 20 in. in the following winter (May).

The results obtained by growing plants in affected soil in pots showed that soil treatment with potassium, manganese, zinc, or boron salts had no effect on the incidence of chlorosis. Plants dressed with iron sulphate at 5 cwt. per acre were normal, while those given a lighter dressing (56 lb. per acre) showed some chlorosis, but less than the controls. Spraying with a 1 per cent. solution of iron sulphate cured the chlorosis, the development of green colour in the leaves becoming noticeable four days after treatment. Marked chlorosis developed in plants sown in winter, whereas plants grown in the same pots in summer were normal. It seems evident, therefore, that there was an increased amount of iron available to the plants in summer.

Reinking (O. A.). **Diseases of Roselle fiber plants in El Salvador.**—*Plant Dis. Reptr*, xxix, 16, pp. 411–414, 1945. [Mimeographed.]

Preliminary observations on the roselle (*Hibiscus sabdariffa* var. *altissima*) disease situation in El Salvador, made in January, 1943, showed the presence of a *Cercospora* leaf spot (on dry material collected the previous June), a stem canker, *Phoma* leaf spot and canker, a pod and seed disease, and a *Rhizoctonia* rot of a few older stems.

Only a few cases of stem canker were found, the lesion being greyish-yellow in the centre, with concentric, grey rings and a reddish border. The canker girdles the stem, killing the upper parts of the plant and reducing fibre and seed production. In every instance a *Sclerotinia*, to which the disease is tentatively attributed, was isolated from affected material in an almost pure state.

The pod and seed disease, characterized by death of the pods and of some of the seeds, is also provisionally attributed to the *Sclerotinia*. The condition was reported to be most common on floral parts near the ground, often below stem cankers, where damp conditions, which favour *Sclerotinia*, prevail.

The *Phoma* leaf spot is not of a serious nature. A stem canker originating at the base of a pod was found to be covered with spores of the *Phoma*. Apparently, the latter phase of the disease is less prevalent than the leaf spot.

Reinking (O. A.). **Preliminary studies of Abacá diseases in Panama.**—*Plant Dis. Reptr*, xxix, 15, pp. 390–393, 1945. [Mimeographed.]

An inspection made by the author in January, 1943, of abacá [*Musa textilis*] plantings in Panama, showed that infection by *Fusarium oxysporum* var. *cubense* [cf. *R.A.M.*, xix, p. 707] was rare on infected banana soil. A so-called stalk rot is characterized by a rot of the leaf bases, usually beginning at the axil, and progressing downwards. The outer, older leaves rot, and produce a collar rot that chokes the plant. Affected plants are stunted and do not fruit. In advanced cases, the top of the plant falls over. Rotted spots occur in the lower part of the pseudo-stem.

The rotted areas extend through the first leaf sheath into the second and sometimes into the third. The outer diseased and dead leaves are generally covered by a white fungal growth, apparently secondary. When top infection is severe, the upper part of the plant is ruined for fibre extraction. Where the disease was severe, growth was found to be very rank and succulent, and it is believed that the trouble may not be serious in normally cleaned and pruned abacá. It appears to be due to a weak parasite that attacks enfeebled leaves, cementing them together and thereby causing secondary collar rot. Improved pruning methods should eliminate the condition.

One area of Bungulanon plants was stunted and weak. The tops were healthy, but the weakened plants could be pulled over easily, owing to the rotted root system. The trouble appears to have been due to some local soil or drainage condition.

Brierley (P.). **Viruses described primarily on ornamental or miscellaneous plants, II.**—*Plant Dis. Reptr, Suppl.* 158, pp. 168–200, 1945. [Mimeographed.]

This supplementary list of viruses of ornamental and other plants [*R.A.M.*, xxiii, p. 438] includes *Arabis* mosaic, aster yellows, California aster yellows, tea phloem necrosis, hemp streak, papaw mosaic, *Cuscuta* latent, *Dahlia* mosaic, carnation mosaic and streak, *Justicia* virescence, *Levisticum* mosaic, lily rosette, cassava brown streak and mosaic, mulberry mosaic, abacá bunchy top, banana bunchy top, flowering cherry banded-chlorosis, locust (*Robinia*) brooming, rose mosaic, sandal leaf curl, streak, and wilt, sandal leaf curl and spike, cineraria mosaic, *Stachytarpheta* mosaic, *Stachytarpheta* rosette, *Stachytarpheta* spike, cacao red mottle, cacao swollen shoot, cacao vein-clearing, elm phloem necrosis, and *Zizyphus* spike viruses.

Watson (R. D.). **Aster yellows and its insect vector in Texas.**—*Plant Dis. Reptr*, xxix, 12, pp. 317–319, 1945. [Mimeographed.]

Studies in the ecology of the aster yellows virus disease [*R.A.M.*, xxiv, p. 420] and its insect vector, *Macrosteles divisus*, show aster yellows as present uniformly on weeds, especially *Lactuca* and *Parthenium*, on marketable carrots, when infection usually means their becoming a total loss, on the Great Lakes variety of lettuce, which became 68 per cent. infected, onions (1 to 2 per cent.), and a trace on spinach. Formerly of no great importance, the disease reached a peak in 1943–4, when 80 to 90 per cent. of the carrots were infected.

An interesting factor was the striking absence of infection in weeds and carrot fields in the Lower Rio Grande valley, particularly in view of the fact that the susceptible weeds *Lactuca* and *Parthenium* were very common. The disease did not become common until country further from the coast was reached. Overwintering of the virus in weeds from north to south is indicated by the presence of the disease from Dallas west and south to Laredo. There was little in east Texas.

Aster yellows seems more common and abundant near towns and cities, except in the Winter Garden region, where it is uniformly distributed in weeds throughout the urban and rural area.

Brooks (F. T.). **Notes on the pathogenicity of Myrothecium roridum Tode ex Fr.**—*Trans. Brit. mycol. Soc.* xxvii, 3–4, pp. 155–157, 1945.

The author describes a series of inoculation experiments with three isolates of *Myrothecium roridum* derived from diseased plants of *Antirrhinum* [*R.A.M.*, xxiii, p. 191] and lupin, and from potato haulms which had been killed by eelworms.

The first was pathogenic to a number of garden flowers and to tomato, but not to potato. The lupin isolate attacked *Antirrhinum* and was more pathogenic to

tomato than the *Antirrhinum* strain, but did not infect potato. The potato isolate was unable to infect any of the test plants. These results show that isolates of the fungus from different sources vary in pathogenicity.

WADE (G. C.). **The control of Botrytis corm rot of the Gladiolus.**—*J. Dep. Agric. Vict.*, xliii, 3, pp. 127–130, 6 figs., 1945.

Corm rot of *Gladiolus* due to *Botrytis* sp. [cf. *R.A.M.*, xx, p. 364] was first recorded in Victoria in 1940, when it was found at Kolorama. It has since been noted on corms from other parts of the Dandenong ranges, the metropolitan area of Melbourne, at Geelong, Ballarat, and on the Mornington Peninsula. It is present in the coastal parts of New South Wales and in Tasmania. Serious losses have been caused, in some cases amounting to over 50 per cent. of the corms of susceptible varieties.

All parts of the plant are attacked. On the corm, the earliest stage consists of a brown discoloration of the core region: later on, the rot spreads along the water-conducting vessels, developing rapidly when it reaches the surface. Severely infected corms may be reduced to a soft, rotten mass. The condition may not be apparent until the scales are removed, though the corm feels very soft when squeezed. If affected corms are kept under moist conditions, the fungus grows on the surface, and develops black sclerotia about $\frac{1}{8}$ to $\frac{1}{4}$ in. in diameter, by means of which the disease is carried over from one season to the next. The infected corms later become mummified.

On the leaves, which do not, as a rule, become infected until after flowering time, the fungus produces small, dead areas with a reddish margin; when many spots are present, the whole leaf turns yellow and dies.

Infected flowers bear water-soaked spots, which often coalesce, destroying the whole flower; numerous grey spores are present. Occasionally, collar rot is present, but this aspect of the disease is not important locally, and is usually attributable to planting infected corms. After the corms are dug, the tops cut off, and the corms placed on the drying racks, spores may reach the old corm on the cut stem end. They germinate, and the fungus thus enters the corms through the core.

To secure protection against infection, the corms should be dipped, as soon after digging as possible, and after being thoroughly washed, in mercuric chloride (1 in 1,000) and agral II (1 in 2,000) for 2 minutes, or in hortosan D P (2 oz. per 10 gals.), zetan (synonymous with new improved semesan bel, 1 lb. per 10 gals.), or aretan (4 oz. per 10 gals.) for 15 minutes. Of these hortosan D P and zetan give the best results. Infected corms should be burnt or buried. Unwanted flowers should be destroyed, never left in the field. The disease may also be avoided by early planting; at Kalorama, corms dug before the second week in March are not likely to become infected. The Miss New Zealand, Pelegrina, Red Lory, King Lear, Elinora, Mrs. S. A. Errey, Black Opal, Champlain, Don Bradman, and Rose Dawn varieties are resistant, and the corms of such varieties need not be dipped. Foliage infection is seldom serious enough to require treatment, but may be controlled by spraying at fortnightly intervals, beginning immediately after flowering, with Bordeaux mixture (6–4–40) plus agral II (1 in 2,000).

BREMER (H.) & İŞMEN (H.). **Studien über Fusicladium, die gefaehrlichste Kernobstkrankheit in der Türkei.** [Studies on *Fusicladium*, the most formidable pome fruit disease in Turkey.]—*Zir. Derg.*, v, 57, pp. 10–18, 5 figs., 1944. [Turkish, with German summary.]

Fusicladium scab of pome fruits is widespread in Turkey, where it causes heavy annual losses. The agents of the disease on apple (*Venturia inaequalis*) and pear (*V. pirina*) flourish in the humid atmosphere of river valleys. Loquats sustain severe damage from scab [*F. dendriticum* var. *eriobotryae*: *R.A.M.*, xix, p. 582]

in the south, where their fruits reach the critical stage of maturity during the rainy period prevailing at that time. The disease (*V.* sp.) also occurs on *Sorbus domestica* [*Pyrus sorbus*: ibid., xvi, pp. 230, 518], but only in a mild form.

The course of infection pursues the lines familiar in Europe and North America. The perithecia ripen during the period from February to the beginning of April, but the dependence of this process on an aggregate of mean temperatures from 1st March onwards observed in Central Europe [ibid., xviii, p. 531] could not be confirmed in Turkey. Experiments on the viability of the conidia at varying temperatures and humidities demonstrated the capacity of these organs to survive for at least six months at 15° to 25° C. irrespective of moisture, at 25° to 35° only in dry air. This persistence of the conidia under hot, dry conditions may explain the prevalence of scab in Turkey. Viable conidia were found throughout the summer in scab lesions, whether of the current season or of several years' standing, on pear twigs, indicating that in Turkey, as elsewhere, this is an important source of inoculum.

A dormant application of concentrated Bordeaux mixture is recommended as the starting-point for the apple and pear scab spraying schedule, but the correct dates for the subsequent treatments must be determined by experiments in the different affected localities. Varietal resistance to the disease has so far been observed only in one locality.

Erikson (D.). **Certain aspects of resistance of Plum trees to bacterial canker. Part I. Some biochemical characteristics of Pseudomonas mors-prunorum (Wormald) and related phytopathologic bacteria.**—*Ann. appl. Biol.*, xxxii, 1, pp. 44–52, 1945.

In a study of the nutrition of *Pseudomonas mors-prunorum*, with special reference to its degree of specialization in the use of sources of carbon and nitrogen, and an investigation of the relationship of this organism with *P. prunicola* and similar pseudomonads isolated from pear and *Syringa*, all the isolates studied except *Bacterium tumefaciens*, *Bact.* [*Xanthomonas*] *pruni*, and pear strain 8 belonged to the green-fluorescent group of *Pseudomonas* (Dowson's group II) [*R.A.M.*, xviii, p. 658], *X. pruni* and pear strain 8 belonging to group III, and *Bact. tumefaciens* to group I.

Omitting pear strain 8, differentiated by its particulate growth, insoluble yellow pigment, and ability to grow on rhamnose, the evidence showed that all the green fluorescent organisms were very closely related as regards their fundamental carbon and nitrogen requirements, and that these can be obtained from a large variety of simple substances. *P. marginalis*, *P. pisi*, *P. tabaca*, *P.* [*medicaginis* var.] *phaseolicola*, *P. cerasi*, *P. fluorescens*, and *P. pyocyaneus* agreed very closely in their general biochemical characteristics. All grew and, as a rule, produced pigment on the simplest media. *Bact. tumefaciens* has more complex requirements, while *X. pruni* agreed in most respects with the pear strain 8.

This work justifies the inclusion of *P. mors-prunorum*, *P. prunicola*, *P. syringae*, and the other *Syringa* and pear strains tested in the general definition of *Pseudomonas* as heterofermentative bacteria, which, while showing an oxidative dissimilation of the products of protein hydrolysis, are able to use the salts of organic acids, and which are differentiated from the acetic bacteria that share the latter characteristic by their inability to utilize sugars and alcohols well. The organisms tested showed some differentiation in their action on succinic acid, an alkaline reaction accompanied by fluorescence being much more rapidly given by *P. prunicola*, *P. syringae* (from apricot), and the pear strains than by *P. mors-prunorum* and the *Syringa* strains. On the other hand, most of the *P. mors-prunorum* strains utilized tartaric acid, which was generally unavailable to the other bacteria.

Sucrose was the one sugar that afforded some basis of discrimination between

the strains. A striking fact was the inability of these organisms to utilize starch, cellulose, or the other polysaccharides tested, except pectin. The only consistent biochemical differentiation shown by *P. mors-prunorum* (including some *Syringa* strains), as compared with *P. prunicola* (including *P. syringae* from apricot and most of the pear strains), was its more rapid production of acid from sucrose. Both *P. mors-prunorum* and *P. prunicola* produced a levan from sucrose, which caused a raised gummy growth on solid sucrose-containing media. This also applied to *P. pisi*, *P. tabaca*, and *P. medicaginis* var. *phaseolicola*, but not to the weakly pathogenic forms or the saprophytes.

On a basis of biochemical characteristics, apart from host pathogenicity, no justification exists for erecting into specific rank these various levan-forming, green-fluorescent, phytopathogenic pseudomonads.

Reid (W. D.). **Bacterial spot of Plum and Peach.**—*N.Z. J. Sci. Tech.*, A, xxvi, 6, pp. 359–366, 5 figs., 1945.

The morphological and cultural characters of *Xanthomonas pruni* are described, and an account is given of its incidence in New Zealand, where it was first recognized in 1929 but only observed to be widespread in 1941, and of its symptomatology on plum and peach (the latter host having hitherto sustained only minor injury on a small scale). The George Wilson, October Purple, and Sultan plum varieties appear to be the most seriously affected: in a preliminary inoculation trial involving 40 varieties, those of English origin were highly resistant. Spraying with Bordeaux mixture 1½-3-50 reduced the incidence of infection in 1943–4 from 27·85 to 7·8 per cent. without important damage to the foliage, which resulted from the same mixture at 3–4–50. The reduction in spotting to 22·37 per cent. effected by the use of zinc sulphate-lime (4-4–50) is considered insufficient to counterbalance the foliar injury arising from this source. Soil dressings with sodium nitrate were ineffectual for the purpose in view, while drastic winter pruning actually increased the amount of infection.

Fresa (R.). **Podredumbre morena de los Durazneros y Ciruelos en el delta del Paraná.** [Brown rot of Peaches and Cherries in the Paraná delta.] –*Rev. argent. Agron.*, xii, 1, pp. 22–25, 1 pl., 1945. [English summary.]

Peaches and cherries in the Paraná delta, Argentina, have sustained heavy damage since 1937 from brown rot, the agent of which was identified, on the basis of its growth characters in culture described by Hewitt and Leach, as *Sclerotinia fructicola* [*R.A.M.*, xviii, p. 533]. In 1937-8 the losses from this source in one fruit-growing section of the delta amounted to 60 per cent. of the crop. The disease occurs in the form of a fruit rot and occasionally as a blossom blight. Inoculation experiments on the flowers and fruits of both hosts resulted in the infection of these organs, but those on the twigs failed to induce canker formation. *S. laxa* was not isolated from the diseased specimens.

McClintock (J. A.). **Sanitary control of black knot of Plums and Cherries.**—*Hoosier Hort.*, xxvii, 3, pp. 45–48, 1 fig., 1945.

Neither spraying nor local excisions have proved very effective in the control of plum and cherry black knot (*Plowrightia morbosa*) [*Dibotryon morbosum*], and the writer accordingly recapitulates information already published in *Rep. Mich. Acad. Sci.* 15, pp. 142, 144, 1913, together with more recent observations in Indiana, on the elimination of the pathogen by sanitary methods. A certain amount of local spread during the summer is caused by conidia, but the ascospores, which are discharged from the knots when spring growth is resumed, provide the main source of inoculum. The fungus is capable of continued development in knots excised from the trees and left on the ground, a fact pointing to the

importance of destroying all diseased material, preferably by burning. Young or newly planted trees usually contract infection from conidia produced in adjacent orchards or on wild plums or cherries, but the fungus may also be introduced on nursery stock, and at least one case of this mode of contamination, involving two-year-old plum trees, is on record in Indiana. Black knots are most easily recognized during the dormant period, when they should be cut out to prevent the emergence of the above-mentioned overwintering ascospores. *D. morbosum* penetrates the limbs beyond the region where the knots appear, so that the branches should be cut several inches below the sites of visible infection. Besides the old-fashioned damson plums, the newer choice varieties, such as Stanley, are susceptible to black knot.

Zeller (S. M.), Owens (C. E.), & Evans (A. W.). **Sour-Cherry leaf-spot control in Oregon.**—*Tech. Bull. Ore. agric. Exp. Sta.* 4, 12 pp., 2 figs., 1944.

In presenting the results of three years' experiments in the control of sour cherry leaf spot (*Higginsia* [*Coccomyces*] *hiemalis*) [*R.A.M.*, xxiii, p. 444] in Oregon, the authors emphasize that the critical period for control depends on the weather and not on the stage of development of the blossoms and leaves. 'Shuck-fall', 'petal-fall', and even the 'two weeks later' applications may be required by the particular climatic conditions obtaining in a given year, and it is all-important to secure thorough coverage of the whole area sprayed. Lime-sulphur gives better control than copper sprays in western Oregon and fermate showed promise as a spray for leaf-spot control, giving as good control as lime-sulphur without causing any leaf injury.

Moore (M. H.). **A note on Medlar cluster-cup rust (Gymnosporangium confusum Plowr.) in Kent in 1943 and 1944.**—*Trans. Brit. mycol. Soc.*, xxviii, 1–2, pp. 13–15, 1 pl., 1945.

In July, 1943, a severe attack of cluster-cup rust (*Gymnosporangium confusum*) [*R.A.M.*, xi, p. 145; xviii, p. 59; xxiii, p. 43] occurred on the leaves and fruit of a medlar tree (*Mespilus germanica*) in Kent growing near two bushes of a variety of the teleutospore host (*Juniperus sabina*). The scattered leaf spots, as seen on the upper surface, were roughly circular, slightly convex, and about 0·5 cm. in diameter. Most of them, brown in the centre, were surrounded by a conspicuous yellow, orange-streaked halo, and many bore spermogonia. The yellowish to pale brown, curved, cylindrical aecidia, up to 4 mm. long, arose from slightly thickened corresponding areas on the lower surface, and were occasionally found on the upper surface. Many affected fruits were found, bearing similar aecidia on swollen areas, mostly on the fruit itself, but sometimes on the calyx. By October, the affected fruits had all dropped. On the leaves, infection did not develop after teleutospore production ceased. In 1944, infection again occurred, but in a much milder form. The spore measurements conformed in general to those of Plowright and Fischer; aecidiospores measured 22 to 26 (average 24)μ in diameter.

An effective means of control would be to remove the *J. sabina* bushes or cut out the hypertrophied shoots before they produce teleutospores. Alternatively, spraying the medlar in spring with Bordeaux mixture (4–6–100) or some other copper fungicide might be tried.

Powers (W. J.). **Epsom salts and nutrient value of berries.**—*Science*, N.S., ci, 2621, p. 301, 1945.

The first successful experiment in the application of magnesium to Oregon soils was made recently in the treatment of gooseberries [*R.A.M.*, xix, p. 605] on silty clay loam with 30 lb. per acre magnesium sulphate. Cane growth and foliage appearance improved, the yield was higher than recorded by other treatments,

and the net profit was $62.25 an acre [ibid., xxiv, p. 196]. High applications of potash to overcome leaf scorch seems to have made the magnesium already present in the soil less available to plants and reductions in potash applications resulted in a new profit of $10.70 per acre treated. The vitamin C content of gooseberries and raspberries grown on soils treated with magnesium sulphate showed, respectively, increases of 24·4 and 4 per cent.

Brentzel (W. E.). **Seed treatment.**—*Circ. N. Dak. agric. Exp. Sta.* 69, 16 pp., 10 figs., 1944.

This circular gives popular notes on seed disinfectants [*R.A.M.*, xxii, p. 472] for cereals, flax, and millet.

Centraalbureau voor Schimmelcultures, Baarn (Nederland). Lijst van Schimmelcultures 1943. [Central Bureau for Fungus Cultures, Baarn (Holland). List of fungus cultures 1943.]—141 pp., 1943. [Received June, 1945.]

In the introduction, contributed by Dr. Johanna Westerdijk, to this list of fungus cultures maintained at the Centraalbureau voor Schimmelcultures, Baarn [cf. *R.A.M.*, xv, p. 38], it is stated that during the period from 1940 to 1942, inclusive, the Bureau's collection was enlarged by 390 species, among the most interesting of the acquisitions being a collection of lignicolous fungi from R. W. Davidson (United States), Blastocladiaeae and Chytridiaceae from R. Harder (Göttingen, Germany), various fungal occupants of seed from P. Neergaard (Copenhagen), and Hymenomycetes from E. Melin (Upsala, Sweden).

Marsh (R. W.). **Presidential address. Mycological contacts.**—*Trans. Brit. mycol. Soc.*, xxviii, 1–2, pp. 1–10, 1945.

In this presidential address to the British Mycological Society, the author cites some examples, mostly from his own experience, of the association of mycology with agricultural research. He emphasizes the value of this association to mycology, and puts forward a plea for similar associations between mycology and the medical and industrial fields. Methods of bringing this end about are briefly discussed in relation to the general problem of the integration of the biological societies.

Cottam (C.). **Eelgrass conditions along the Atlantic seaboard.**—*Plant Dis. Reptr*, xxix, 12, pp. 302–310, 1945. [Mimeographed.]

This survey records a marked improvement of the eelgrass plant (*Zostera marina*) wasting disease [*R.A.M.*, xxiv, p. 240] along many sections of the American Atlantic coast. Recovery occurred both in bays and coves with reduced salinity, and in almost unmodified sea water; on the other hand, the disease was also active in regions of reduced salinity and in some of the more open bays. No improvement was reported by H. F. Lewis in the eelgrass situation on the north shore of the St. Lawrence or on the coast of Nova Scotia, but some improvement occurred on the Quebec coast. A. E. Addy reported in August, 1944, a rather widespread attack of the disease with characteristic symptoms of *Labyrinthula macrocystis* [loc. cit.] on the Massachusetts coast. Notable improvements were reported by the Long Island Game Protection Association and the United States Game Management Agencies for Long Island and New Jersey.

The author points out that no other plant disease has spread so quickly or with such catastrophic consequences to a plant species. The effect on coastal fishery resources and upon sea brant, geese, and other coastal waterfowl has been most serious; the situation in any local area remains highly variable and unpredictable.

Gregory (P. H.). **The dispersion of air-borne spores.**—*Trans. Brit. mycol. Soc.*, xxviii, 1–2, pp. 26–72, 6 graphs, 1945.

In this paper the author examines in detail the nature and magnitude of the factors that control the scattering of air plankton, reviews the literature of the subject in order to ascertain whether the observed distributions of plant pathogens follow recognizable patterns, and finally discusses the application of the subject to the study and prevention of air-borne diseases of field crops [*R.A.M.*, xxiii, p. 310].

The conclusions reached may be summarized as follows. The deposition of air plankton, such as passively air-borne pollen grains or fungal spores, decreases with increasing distance from a given source. The terminal velocities of spores depend on their size, and are roughly what may be expected for smooth, spherical particles from Stokes's law, but moderately wide deviations between observed and expected values are probably due to surface roughness and asymmetry. Fungal spores fall at velocities between 0·04 and 2·5 cm. per sec., and pollen grains at velocities between 1·5 and 40 cm. per sec. The mean wind velocity at 10 m. altitude is about 300 cm. per sec. Attempts to calculate the dispersal of spores as the resultant of vertical fall under gravity and horizontal wind movement apply only to non-turbulent air movement, and are inapplicable at more than a few mm. above the earth's surface. Differences in rate of spore fall are probably not major factors in dispersal. It is more appropriate to consider a spore cloud in suspension in the air in process of dilution by eddies in the course of its transport by the wind.

In support of the concept of the spore cloud as a suspension it is shown that at heights in the atmosphere above the surface layers, the concentration of pollen and spores decreases exponentially with increasing height in the manner that would be expected if particles falling under gravity were balanced by other particles diffused upwards by eddies. The values for eddy diffusivity, K, varying from $1{\cdot}5 \times 10^4$ to $3{\cdot}3 \times 10^5$, deduced for spores and pollen, are of the order usually found in meteorological work.

Terminal velocity, while it may play only a small part in spore dispersal, may be more important in causing deposition of spores brought down by eddies to the boundary layer of relatively still air a few cm. thick at the earth's surface.

Based on Sutton's theory of eddy diffusion, equations are given for the deposition of spores at various distances from a point source, while from Stepanoff's data [ibid., xv, p. 383] it is concluded that in travelling across 1 sq. cm. of surface there are deposited the equivalent of the number of spores present in a layer on the axis of the cloud about $\frac{1}{2}$ mm. thick. This value is expressed as a coefficient of deposition, p, and is regarded as a parameter of much biological significance. Observed gradients of air-borne plant infections originating from a point source are shown to be closely predicted by the deposition theory, while splash-dispersed fungi slow gradients incompatible with it. An approximate formula is given for gradients from strip sources, and observed gradients show reasonable agreement.

The significance for plant hygiene of this work is that, while attention should be paid to isolation, most emphasis should be placed on eliminating foci of infection within a crop.

A list of 89 bibliographical references is appended.

Conover (R. A.) & Stevens (N. E.). **A Penicillium 'disease' of ink.**—*Trans. Ill. Acad. Sci.*, xxxv, 2, p. 59, 1942. [Received June, 1945.]

Blemishes in the form of pale reddish-brown spots on soap wrappers were found to be due to the contamination of the ultramarine blue dye used in the printing by a hitherto unidentified species of *Penicillium*.

Healy (C. P.) & Niven (J. C.). **Mould and humidity in radio and signals equipment.**—*Proc. Inst. Radio Engrs. N.Y.*, xxxiii, 5, pp. 300-306, 8 figs., 1944.

This paper is concerned with radio equipment constructed by pre-war methods and used in areas north of Australia, under tropical conditions, where mould growth is severe and this, in addition to the effect of humidity on the components, may render the equipment inoperative shortly after arrival in the fighting zones. The authors then proceed to describe infection and methods for its control in various classes of equipment.

Organic dust is probably the source of mould nutrient on metal surfaces and damages may occur through by-products of mould growth. Electrical insulation suffers damage from saturated mould causing surface leakage: the mycelia of moulds are conductors. Control measures are directed towards the elimination of materials causing mould growth and their replacement by non-affected material, and treating mould-susceptible materials with suitable fungicides.

The growth on cotton-braided, rubber-covered wire which is thinly lacquered is prolific. As the mould holds water in a saturated atmosphere, the surface insulation drops to a few ohms per yard. One per cent. copper naphthenate or trichlorphenol in paraffin, or 1 per cent. salicylanilide in methylated spirits render this wire immune from mould growth on immersion.

Polyvinyl chloride or vulcanized rubber covering without additional braids and, in some cases, polyvinyl chloride covering with a fibreglass braid have proved satisfactory in the protection of connecting wires. Replacement of cotton by plastic sleeving has proved more satisfactory than treating the cotton for the prevention of rot. Latex solution, an adhesive for fixing labels on smooth surfaces and highly susceptible to mould growth, resists growth on the addition of 20 gm. salicylanilide per gal. solution, and thick films of cellulose-nitrate lacquer protect paper labels effectively for as long as twelve months. Paper labels should, however, be avoided if possible, as, apart from obliteration of the printing, the paper is rotted to disintegration by the mould.

Treatment of synthetic resin-bonded paper sheet by high-grade oleo- or alkyd resin varnishes lessens serious loss of insulation resistance in damp tropical areas, without preventing it, and where possible it should be replaced by ceramics, polystyrene, mica, or similar materials. Likewise, fabric-filled phenolics and wood-flour-filled materials may show mould growth more or less and lose insulation resistance in humid conditions, and mica-filled phenolic moulding materials are superior to the latter. Micanol or English xmb262 seem satisfactory, but do not compare with ceramics or polystyrene. Drying and treating with a thin coating of polystyrene lacquer give improved surface protection of unglazed ceramics.

Reports from New Guinea show that leather in any form grows mould and disintegrates in a few weeks. It should where possible be replaced by webbing or some other fabric responsive to treatment.

One per cent. solution copper naphthenate, salicylanilide, or trichlorphenol, the first by weight of copper and the others by weight of compound, prevent mould growth on canvas and duck, though one specimen of birkmyre (English) canvas, treated by the manufacturers, actually resisted mould on test. Cords for cable-tying and aerial guy ropes can be treated similarly.

Copper naphthenate solution prevents mould growth and termite attack on woodwork but does not protect plywood bonded with casein or gelatine glues. Urea-formaldehyde or phenol-resin glues are satisfactory bonding materials, but the wood still requires fungicidal treatment.

Dry batteries suffer when sent to the tropics in untreated cardboard containers. They should be sealed in metal cases filled with a plastic petroleum asphalt. Other

apparatus discussed include power-transformers, paper capacitors, and intermediate-frequency and radio-frequency inductors.

Immunity of varnish or lacquer through fungicidal treatment does not necessarily protect the base material where this provides nutrient for mould growth. 'Fungiciding' the base-material has proved a superior method of preventing mould growth to incorporating fungicides in paints, varnishes, and lacquers. Casualties to electrical equipment usually occur during storage and transport and it is important that the wood in packing-cases should be treated with copper naphthenate against termite and mould attack.

As a general rule, it is better to use material such as the vinyl plastics, mica, ceramics, and like products, which are unaffected by mould and humidity, than other materials, which prove unsatisfactory even when treated.

It is recommended that equipment supplied to tropical areas should be hermetically sealed in containers.

The resistance of materials and components to mould and humidity is determined in two test atmospheres: subjection to 70° for eight hours, cooling to ambient over 16 hours, then transfer to a chamber maintained at 60°±2° and 95 per cent.±5 per cent. relative humidity for six hours. The closed chamber is cooled over a period of 16 hours. The above cycle is repeated once. A static humidity test has also been developed in which the test chamber is maintained at a temperature of 86°±2° and a relative humidity of 95 to 100 per cent. with condensation predominating. This chamber is used both for static humidity and mould-testing. Before exposure in the static-humidity atmosphere, materials and components are sprayed by means of an atomizer with a suspension of mixed spores of the following species: *Aspergillus glaucus*, *A. niger*, *Penicillium luteum*, *P.* No. 40, *Memnoniella echinata*, and *Rhizopus nigricans* [*R. stolonifer*].

Bayley (C. H.) & Weatherburn (M. W.). **Rotproofing cotton fabrics.**—*Canad. Text. J.*, lxii, 5, pp. 34, 36, 46, 1945.

A tabulated account is given of an investigation conducted at the National Research Laboratories, Ottawa, on the copper naphthenate [see preceding abstract] tolerance of the cellulose-destroying fungi, *Chaetomium globosum*, *Metarrhizium glutinosum*, and *Aspergillus niger*, and on the effect of mercuric naphthenate on *A. niger* and a *Penicillium* isolated from orange-coloured areas on copper-treated cotton fabrics subjected to the standard soil burial test [*R.A.M.*, xxiv, p. 331]. The culture medium and method of inoculation were those prescribed by Thom *et al.* (*Amer. Dyest. Reptr*, xxiii, p. 581, 1934). The trial samples, consisting of pieces of light cotton sheeting 1 in. sq., were immersed in copper naphthenate solutions at concentrations ranging from 0·005 to 0·8 per cent. and incubated at 30° C.

All the organisms were capable of growth at the lower copper dosages. *C. globosum* was partially and totally inhibited at 0·1 and 0·3 per cent., respectively, and *M. glutinosum* at 0·07 and 0·5, respectively, whereas *A. niger* continued to develop freely at 0·8.

Another series of experiments was carried out to determine the effects of leaching, artificial weathering, waterproofing wax, and 25 per cent. mercury-containing mercuric naphthenate on the growth of *A. niger* and the above-mentioned species of *Penicillium* on a copper naphthenate-treated No. 8 cotton duck fabric.

Both organisms grew readily on the copper naphthenate-treated samples even in the presence of wax, whereas the development of *A. niger* was brought to an almost total standstill by 0·03 per cent. mercuric naphthenate and completely inhibited at 0·1, the latter concentration also entirely arresting the growth of the more resistant *Penicillium*. Considerable loss in breaking strength was registered in the untreated and leached (for 24 hours) and weathered (400 hours in a

weatherometer), copper naphthenate-treated samples attacked by the *Penicillium*, which was not repelled by the inclusion of waterproofing wax (a mixture of paraffin wax and No. 2 petrolatum grease, 3 : 1) in the solution, but the addition of increasing amounts of mercuric naphthenate obviated this defect to some extent.

Snow (D.). **Mould deterioration of feeding stuffs in relation to humidity of storage. Part III. The isolation of mould species from feeding stuffs stored at different humidities.**—*Ann. appl. Biol.*, xxxii, 1, pp. 40–44, 1945.

In this further account of studies on the mould deterioration of feeding stuffs [*R.A.M.*, xxiii, p. 397] stored at different humidities, the author states that the moulds most likely to occur in commercial storage are those able to develop at humidities of 85 per cent. or less. *Penicillium* species were unable to grow below 75 per cent. R.H., and flourished only at or above 85 per cent. R.H., whereas *Aspergillus* species developed in a very restricted moisture supply. *A. echinulatus*, *A. repens*, and *A. ruber* developed at humidities of 70 per cent. and under; *A. chevalieri* and *A. amstelodami* at 80 per cent. and over; *A. candidus*, 70 per cent. and over; *A. penicilloides*, 75 per cent. and over; *A. versicolor* and *A. sydowi*, 85 per cent.; and *A. niger*, 90 to 100 per cent.

At humidities under 80 per cent. the limited number of species able to develop often required long latent periods before spore germination could occur. At humidities over 80 per cent. a succession of species developed on many samples. At 100 per cent. R.H., for instance, members of the Mucorales established themselves in two or three days and were the dominant mould present. After a week, however, members of the *A. glaucus* group and *Penicillium* species grew rapidly on these samples, and became the dominant moulds at the expense of the Mucorales. *A. niger* did not appear until nearly two weeks had elapsed, while the slower-growing forms, such as *A. candidus*, did not develop until after three weeks. Some members of the Fungi Imperfecti, e.g., *Sporotrichum* sp., were not evident early in storage, but later provided the dominant moulds on many of the samples stored at high humidities. Species well adapted to growing on feeding stuffs, such as members of the *A. glaucus* group and, at 85 to 100 per cent. R.H., *Penicillium* spp., developed at the expense of species less well adapted.

Infection may, conceivably, occur in the field, during processing, or during transit or storage of the raw material or the processed feeding stuff. Some of the fungi isolated could, probably, have been traced to the country of origin of the original plant constituents of the feeding stuffs, particularly in the case of imported oil-seed cakes manufactured in tropical or sub-tropical countries; *A. chevalieri* is a common contaminant of foodstuffs from such parts. Feeding stuffs manufactured in Great Britain from imported materials are partially sterilized by the heat treatment received during processing, but mould contamination readily takes place afterwards from the machinery, workers' clothing, sacks, and the air in the storage rooms.

The range of feeding stuffs from which *Aspergillus* spp. and *Penicillium* spp. were isolated was as follows. *A. repens* was obtained (at 67 to 100 per cent. R.H.) from bone meal, bran, dried grass, groundnut cake, linseed cake, locust beans [*Ceratonia siliqua*], oats, and Scotch beans; *A. ruber* (at 70 to 100 per cent.) from bran, groundnut cake, linseed cake, locust beans, and Scotch beans; *A. chevalieri* and *A. amstelodami* (at 80 to 100 per cent.) and *A. echinulatus* (at 65 per cent.) from linseed cake. Of species outside the *A. glaucus* group, *A. candidus* was isolated (at 70 to 100 per cent.) from bran, linseed cake, locust beans, and oats, *A. penicilloides* series (at 75 to 100 per cent.) from bone meal and oats, *A. versicolor* (at 85 to 100 per cent.) from linseed cake and oats, and *A. sydowi* (at 85 to 100 per cent.) and *A. niger* series (at 90 to 100 per cent.) from linseed cake.

Paecilomyces varioti was obtained from palm-kernel cake stored at 70, 85, 95,

and 100 per cent. R.H., *Penicillium spinulosum* from linseed cake, oats, and palm-kernel cake at 75 to 100 per cent., *P. luteum* series from palm-kernel cake at 90 to 100 per cent., *P. cyclopium* from linseed cake and palm-kernel cake at 90 to 100 per cent., and *P. rugulosum* from palm-kernel cake at 100 per cent.

The frequent occurrence of the small-ascospored species of the *A. glaucus* group particularly *A. repens* and *A. ruber* on such a wide variety of feeding stuffs, at humidities of 67 to 100 per cent., indicates that these species are those best adapted for growth on materials in which the moisture supply is limited. Mould damage to feeding stuffs in commercial stores is probably mainly due to these forms, but under conditions of prolonged high humidity (over 85 per cent.), other species of *Aspergillus* (e.g., *A. sydowi* and *A. versicolor*), and of *Penicillium* and other moulds can become established.

Demerec (M.). **Genetic aspects of changes in Staphylococcus aureus producing strains resistant to various concentrations of penicillin.**—*Ann. Mo. bot. Gdn*, xxxii, 2, pp. 131–138, 3 figs., 1945.

In experiments with *Staphylococcus aureus*, strains resistant to penicillin were developed which retained that property after 20 transfers in broth. Experimental evidence indicates that resistance is not induced by the action of the penicillin, but originates as a change comparable to mutation. In any large population of bacteria there are some individuals resistant to certain low concentrations of penicillin. If this population is exposed to the action of such concentrations of penicillin, non-resistant individuals are eliminated while the resistant survive.

Thaysen (A. C.). **Food yeast: its nutritive value and its production from Empire sources.**—*J.R. Soc. Arts*, xciii, 4693, pp. 353–361, 3 figs., 1 graph, 1945.

In this paper, read before the Royal Society of Arts on 20th March, 1945, the author discusses the dietetic value of yeast, deals in some detail with food yeast production [*R.A.M.*, xxiii, pp. 399, 494], and gives a succinct account of the manufacturing plant which, it is hoped, will soon be in full production in Jamaica. The paper is followed (pp. 361–364) by a discussion.

Meyer (J. R.). **Método para proteção das Orquídeas quando retiradas dos recipientes de cultura para adatação ao meio exterior.** [Method for the protection of Orchids on withdrawal from culture vessels for adaptation to the external medium.]—*Biológico*, xi, 2, pp. 48–51, 2 figs., 1945.

Full directions are given for the protection from insect contaminants of orchid seedlings during the transition period between their withdrawal from the asymbiotic medium recommended for the initial growth phase [*R.A.M.*, xxiv, p. 200] and transference to their permanent quarters. The interval of four to six months should be spent packed in tubes containing soft, damp 'xaxim', with cotton wool or gauze stoppers, kept in a well-lighted room at a temperature ranging from 20° to 37° C.

Vasilkov (B. P.). К систематике основника **Boletus versipellis Fr.** [The systematic position of *Boletus versipellis* Fr.]—Советск. Бот. [*Sovetsk. Bot.*], 1944, 2, pp. 21–27, 1944.

The author considers the mycorrhizal fungi *Boletus aurantiacus*, *B. rufescens*, *B. ericetorum*, and *B. arcticus* [*R.A.M.*, xx, p. 547], commonly found in Russia, to be forms of *B. versipellis*, whilst another fungus found in a plantation of birch and pine, with aspen undergrowth, was similar to, but distinct from *B. versipellis*, and is described as *B.* (*Krombholzia*) *percandidus* n. sp. At first glance it might be taken for an albino form of *B. versipellis*, but the black-brown discoloration

on compression of the pileus and stipe, the yellow-white pores, and the thick, large, rough scales on the stipe are foreign to that species.

Bisby (G. R.). **Longevity of Schizophyllum commune.**—*Nature, Lond.*, clv, 3946, pp. 732–733, 1945.

On 5th March, 1945, the writer opened a tube containing five parts of pilei of *Schizophyllum commune* collected at Winnipeg, Canada, by the late Professor A. H. R. Buller in October, 1909, and kept since December, 1910, in a vacuum in the dark at room temperature. When placed in a damp chamber, all the parts expanded but only one shed spores, which it did continuously until its removal after three days. Some of the asymmetrical spores, measuring 6 to 7·5 by 2μ (the normal dimensions for the species), germinated in water. Gill sections of this fan-shaped piece of pileus showed normal basidia, sterigmata, and spores in various stages of development. A whole pileus from another tube opened on 8th March was placed on agar and rapidly started to produce spores, practically all of which germinated. Pure cultures were thus readily obtained, the hyphae of which developed clamp-connexions. Transferred after two days to a damp chamber, the pileus proceeded to form spores until 31st March. Meanwhile, rudiments of new pilei were formed near the margin, one of which expanded to 10 by 6 mm. and shed spores from 23rd March until 2nd April.

A tube containing two pieces of pilei of *S. commune*, also collected in 1909, which had been sealed in a very high vacuum on 5th June, 1912, was opened on 1st March, 1945; one piece sporulated normally when moistened. Similar results were obtained with a portion of a pileus from one of the 1910 vacuum tubes that had been immersed in liquid air (−190° C.) for three weeks in 1912 and was opened on 8th March, 1945.

Each of the four tubes opened contained a specimen still living 35½ years after it had developed, of which 34¼, or in one instance 32¾, were spent *in vacuo*. Eleven of the vacuum tubes await further investigation.

Panassenko (V. T.). Экология плесневых грибов. [Ecology of the moulds.] – Микробиология [*Microbiology*], xiii, 4, pp. 159–170, 1944.

In this ecologic study on moulds, which are defined as an ecologic group containing members of various systematic groups, the author surveys the various factors affecting growth, of which temperature and relative humidity are the most important. Moulds developing below 0° C. are classified as cold-tolerant, those growing from 5° to 30° (with an optimum of 20° to 25°) as intermediate, and those growing between 40° and 50° as heat-tolerant.

The range of humidity at which fungi develop is more limited than that of temperature, and moulds are hygrotolerant when they develop in 90 to 100 per cent. relative humidity, intermediate in 80 to 90 per cent., and xerotolerant in 65 to 80 per cent. Other factors include P_H range, presence or absence of oxygen (which is usually essential for growth), and concentration of the medium. *Oospora halophila*, for example, is cited as developing in a 50 per cent. solution of common salt, and *Penicillium cupricum* as tolerating 9·5 per cent. copper sulphate. Elements like copper, iron, and zinc may set up great changes. Examples of the effect of all these factors are given.

Rice (Mabel A.). **The cytology of host-parasite relations. II.**—*Bot. Rev.* xi, 5, pp. 288–298, 1945.

In continuation of her earlier paper [*R.A.M.*, xv, p. 108] the author reviews and discusses studies by numerous workers during the past ten years upon the physiology of parasitism with special reference to rusts. A bibliography of 37 titles is appended.

Van der Plank (J. E.) & Wasserman (J. W.). **Mass production of virus-free Potatoes.**—*Nature, Lond.*, clv, 3948, pp. 794–795, 1945.

Under the powers given by the Agricultural Pests Act, 1911, a reserve comprising the Riet River Settlement and all land within ten miles of it has been set aside in South Africa for growing virus-free potatoes [cf. *R.A.M.*, xxiv, p. 162], the aim being to produce 5,000 tons virus-free seed per annum.

Raeder (J. M.). **Diseases of Potatoes in Idaho.**—*Bull. Idaho agric. Exp. Sta.* 254, 39 pp., 19 figs., 1944.

Popular notes are given on a number of well-known parasitic and non-parasitic diseases of potatoes in Idaho, with directions for their control and a special section on seed treatment.

Foister (C. E.), Wilson (A. R.), & Boyd (A. E. W.). **Potato dry rot and gangrene as soil-borne diseases.**—*Nature, Lond.*, clv, 3948, pp. 793–794, 1945.

Experiments conducted in Scotland in 1943, in which random samples of soil were taken from 20 fields and Doon Star potatoes inoculated with small quantities of each, showed that *Fusarium caeruleum* [*R.A.M.*, xxiii, pp. 453, 497] may be present in soil at least two years after the last potato crop. Marked variations in the degree of infestation of the soil samples were detected. Other evidence demonstrated that *Phoma foveata* [ibid., xx, p. 91] is soil-borne.

Cassell (R. C.). **Fusarium rots and storage diseases of Potatoes in New York.**—*Plant Dis. Reptr*, xxix, 13, pp. 337–342, 1945. [Mimeographed.]

The author presents the results of an examination of 356,500 bush. potatoes in 58 lots of 30 to 42,000 bush. from six counties of New York State in March, 1945.

Fusarium rots were found in 34 of the 58 lots, average prevalence being 5 per cent. with maximum 17, attributed tentatively to *F. sambucinum* and several rots presumed to be caused by *Fusarium* but not otherwise identified. *F. sambucinum* was by far the most common in all six counties, being present in 27 of the 34 bins, the Chippewa, Sequoia, and Sebago varieties proving to be the most susceptible. *F. sambucinum* seems to cause disintegration of the tissue, leaving a dry cast as the rot progresses into the flesh of the tuber. As a result the skin tends to form a shrivelled but fairly firm cover over a dry cast of disintegrated flesh of depth varying with the activity and progress of the fungus, and extending over a small to large area. In some cases surface disintegration may almost keep pace with interior collapse and in others the interior disintegration may proceed faster, forming a shallow, dry pit concealed by the firm, dry cast covered by the partially shrivelled skin. Surface and fleshy tissues change from black to deep brown with age, and infection is apparently possible wherever a wound occurs. In this survey the average percentages of *F. sambucinum* rot observed in the varieties Sebago, Pontiac, Katahdin, Chippewa, and Rural were 10·7, 7·0, 1·2, 1·0, and 0·36, respectively, for all bins examined.

Stone (G. M.) & Wilson (C.). **Late blight of Potatoes in Baldwin County, Alabama, in 1945.**—*Plant Dis. Reptr*, xxix, 15, pp. 378–381, 1 map, 1945. [Mimeographed.]

There is no authentic record of potato blight (*Phytophthora infestans*) in Baldwin County, Alabama, before 1940, when a trace of the disease was found. Prevalence, however, gradually increased, and in 1944 more than 60 per cent. of the crop was destroyed. Field observations indicated that blighted seed potatoes were the source of almost all the infection, wind-borne inoculum, apparently,

having played only a minor part. In fields where much disease developed, the focal point of infection could usually be found, from which infection diminished rapidly in all directions.

WAGER (V. A.). **Early blight in Potatoes.**—*Emg S. Afr.*, xx, pp. 318–320, 2 figs., 1945.

The author describes the characteristics distinguishing potato early blight (*Alternaria solani*) [*R.A.M.*, xxii, p. 223] from late blight (*Phytophthora infestans*) and from the virus disease kromnek [tomato spotted wilt virus: ibid., xxii, p. 396], which infects occasional plants, whereas early blight usually infects the whole crop. Early blight spreads rapidly in dry weather, particularly if there are heavy dews. Successive early morning spraying with Bordeaux mixture or dusting with copper-lime dust often enough to keep the new leaves covered is recommended. Hand-working dusting machines are once again obtainable in South Africa and copper-lime dust is plentiful, 20 to 30 lb. an acre being required. Success largely depends on frequent dustings.

JOSEFSSON (A.). **Rostfläcksjuka hos Potatis.** [Rust spot disease of Potatoes.]—*Sver. Utsädesfören. Tidskr.*, lv, 1, pp. 34–42, 1 fig., 1945. [English summary.]

The symptoms of a disease affecting certain potato varieties, notably Alpha, Ackersegen, Dir. Johannsen, and Erdgold, on alkaline (P_H7) sandy soils in the south of Sweden appear to agree with those of internal rust spot (or spraing as described by Chupp from the United States [cf. *R.A.M.*, iv, p. 560]). The examination of tubers of the two first-named varieties, cut from end to end into eight sections of uniform thickness, revealed a marked decrease in the percentage of discoloured tissue towards the crown end, while in cases of severe attack the navel end is less affected than the centre. For instance, the percentage of discoloration in eight consecutive sections of Ackersegen, reckoning from the navel end, were 70, 90, 90, 70, 53, 37, 23, and 13, respectively, the corresponding figures for Alpha being 72, 91, 81, 72, 50, 47, 41, and 25, respectively.

A rough test was carried out to check the possible connexion between the disease and manganese deficiency, in which manganese peroxide was incorporated into the soil at the rate of 30 kg. per ha. before planting the Alpha tubers, while another section of the plot also received an additional 50 kg. of the compound in the form of a spray solution during early growth. The double treatment resulted in complete freedom from the disorder, 16 per cent. of which developed both in the untreated section and in that given the pre-planting application only.

FORD (C. E.). **Experiments on the control of bark rot.** —*Quart. Circ. Ceylon Rubb. Res. Scheme*, xxi, 1–4, pp. 29–34, 1944.

The author describes a number of experiments in connexion with tapping canker, a disease of the renewing bark of *Hevea* rubber in Ceylon, which became serious in 1943, and is different from the usual bark rot (*Phytophthora palmivora*). Out of 172 clones 40 were found to be affected. The first symptoms observed were small, roughly circular, depressed patches on the renewing bark, from ½ to 1 in. above the tapping cut. The surface was black and often peppered with a white mycelium; the tissue was devoid of latex, waterlogged, and yellowish-brown. In some trees the infection spread into healthy bark below the tapping bark, usually through a vertical crack, and sometimes into virgin bark above. At least one instance was noted, however, of spread from a primary infection on virgin bark downwards into the renewing bark. A secondary effect is the appearance of vertical cracks in the renewing bark at the site of naturally healed diseased patches, accompanied by bleeding and the development of pads of coagulated latex at the level of the cambium. A *Phytophthora* sp. was isolated

from diseased bark of an MK3/2 tree, but has not yet been identified and inoculation experiments were inconclusive.

In Ceylon both black stripe and canker of the bark have been attributed to *P. palmivora*. The marked difference, however, between the symptoms of black stripe and those of tapping canker strongly suggest that different physiologic races may be involved.

The results of experiments with five unspecified disinfectants showed that all these combinations effectively controlled both tapping canker and black stripe. Tapping canker can, however, only be remedied by disinfectant treatment in the early stages and patches exceeding $\frac{1}{2}$ in. in diameter must be treated by scraping.

Fricke (E. F.). **Molybdenum deficiency in the north-east.**—*Tasm. J. Agric.*, xvi, 1, pp. 2–4, 2 pl., 1945.

The author discusses the results of 30 pasture trials in 1944 designed to test the efficacy of molybdenum [*R.A.M.*, xxiv, pp. 316, 337] as a means of soil renovation and improving colour and productivity in clover. The treatments, including two with 12·3 lb. ground molybdenite ore (containing 1 lb. molybdenum) per acre allied, respectively, with 1 cwt. superphosphate and 1 ton lime, and with 1 cwt. superphosphate alone, were replicated five times. The results showed that whether lime was present or not, and allowing for the increase due to superphosphate if present, molybdenum gave an increase in yield of green herbage of 60 to 70 per cent.

Stevenson (E. C.). **Alternaria ricini (Yoshii) Hansford, the cause of a serious disease of the Castor-Bean plant (Ricinus communis L.) in the United States.**—*Phytopathology*, xxxv, 4, pp. 249–256, 4 figs., 1945.

The designation of the agent of the castor bean (*Ricinus communis*) leaf spot under discussion was changed by Hansford [*R.A.M.*, xxiii, p. 409] from *Macrosporium ricini* Yoshii [ibid., xxiii, p. 358] to *Alternaria ricini*. During the second world war, the demand for this important commodity increased, and in connexion with a project for domestic production to counteract the curtailment of imports, varietal tests were undertaken which revealed serious damage to the seedlings, leaves, and inflorescences. Two types of symptoms may be observed on the capsules, one involving sudden wilt, purple or dark brown discoloration, pedicel collapse, paucity of seeds, and failure of normal dehiscence, and the other characterized by a unilateral sunken area which gradually enlarges to cover the whole pod. In heavily infected plots all the young racemes and even flower primordia are killed. Following very humid periods the diseased inflorescences acquire a black, sooty appearance from the extensive spore deposits on the surface. At the first harvest at the Plant Industry Station, Beltsville, Maryland, on 6th September, 1943, the conidia rose in clouds of dust from the capsules, blackening the workers' hands. Of a total of 3,603 plants covering an area of some five-sixths of an acre 70 per cent. were estimated to be more or less affected on the 15th. Some leaf-spotting and premature defoliation occurred throughout the season, and an intensification of these symptoms coincided with the spread of raceme infection. By the end of August, 1943, the defoliation of some selections was almost complete.

Apart from its slightly longer conidia (47 to 96, mean 70 μ, exclusive of the beak, which measures 51 to 200, mean 112 μ), the species under observation conforms closely to *A. ricini*, as described by Yoshii, but disagrees in various features with other related fungi on the same host.

Inoculation experiments on the capsules were successful only through wounds. Foliar infection was obtained by atomizing seedlings in moist chambers or under bell jars with aqueous spore suspensions. When seed from infected capsules of the Conner and Doughty 11 varieties was planted in sterilized soil in the green-

house, 72 per cent. of the seedlings arising from the former and 17 per cent. of those from the latter developed the typical symptoms. Isolates of the fungus were obtained from 32 out of 34 samples of *R. communis* seed from the 1942 crop in 34 different localities, while in 1943 the conidia were borne in profusion on the surface of capsules from Texas, Louisiana, Mississippi, Georgia, South Carolina, Tennessee, Kentucky, and Arkansas. So far no scheme of control has been developed, but there are indications that seed treatment may be of value in combating the initial phase of the blight.

Pinkus (R.). **El injerto de la Chinchona. (Continúa.)** [*Cinchona* grafting. (Continuation.)]—*Rev. agríc., Guatemala*, xxii, 1, pp. 135–140, 4 figs., 1945.

The following item of phytopathological interest occurs in this description of *Cinchona*-grafting methods in Guatemala. A. S. Müller has identified as a species of *Phytophthora* a fungus responsible for the destruction of 3·75 per cent. nursery grafts in 1943 and of apparently comparable prevalence in 1944. Starting as a small, coffee-coloured spot, infection spreads over the leaf until it reaches the midrib, whence it proceeds downwards to the main stem and ultimately kills the graft. Hitherto control has been effected by bi-weekly inspections of the plantations during the rainy season and weekly ones in dry weather, when diseased foliage is removed and burnt. Marked variations in the reaction of individual clones to the pathogen have been observed, and it has further been noted that nurseries exposed to the morning sun and situated on good soil sustain less damage from this source than those deprived of these advantages.

Unamuno (L. M.). **Contribución al estudio de los hongos microscópicos de la provincia de Cuenca.** [Contribution to the study of the microscopic fungi of the province of Cuenca.]—*An. Jard. bot. Madr.*, ii, pp. 7–86, 19 figs., 1942. [Received June, 1945.]

The 152 species of fungi herein listed with critical annotations were collected in July, 1932, in the province of Cuenca, where very little mycological exploration has been carried out. The species include 19 new to science and 23 new to the Spanish mycoflora. Among those of special interest may be mentioned *Melampsora lini* on *Linum catharticum*, *Coniothyrium fuckelii* on barberry, *Crumenula laricionis* n.sp. on *Pinus laricio*, *Ascochyta graminicola* on *Phleum pratense*, *Marssonia* [*Marssonina*] *juglandis* [*Gnomonia leptostyla*] on walnut [*R.A.M.*, xi, p. 79], in association with *Microstroma juglandis*, *Ramularia cynarae* on artichoke, and *Hadrotrichum populi* [ibid., xxii, p. 180] in the company of *Septoria populi* on poplar (*Populus pyramidalis*).

The presence of *Aecidium berberidis* [*Puccinia graminis*] on barberries, taken in conjunction with the extraordinary number of Gramineae attacked by this rust, suggests that Cuenca may constitute a centre of dispersal for wheat black rust.

C. laricionis is characterized by cylindrical to clavate asci, 90 to 95·4 by 10 to 12 μ, furnished with a short, bifurcate pedicel; numerous filiform, simple, continuous paraphyses, exceeding the asci in height; and fusoid, continuous ascospores (eight per ascus), acuminate at both ends, 17 to 19 by 3·6 to 4·6 μ, bi- to quadriguttulate, and provided with a membrane 1·5 to 1·8 μ in thickness.

Losa España (D. M.). **Aportación al estudio de la flora micológica española.** [Contribution to the study of the Spanish mycological flora.]—*An. Jard. bot. Madr.*, ii, pp. 87–142, 8 figs., 1942. [Received June, 1945.]

The following records occur in this list. *Aecidium berberidis* [*Puccinia graminis*] on barberry [see preceding abstract] in the province of León, *P. maydis* on maize

in the environs of Santiago and in Mirando de Ebro, *P. porri* on onion (Mirando de Ebro, 1939), *Bremia lactucae* on *Lactuca virosa* in León, and *Plasmopara nivea* on parsnip in Miranda de Ebro.

Jordán de Urríes y Azara (M.). **Hongos microscópicos de Navarra.** [Microscopic fungi of Navarre.] *An. Jard. bot. Madr.*, ii, pp. 143–171, 6 figs., 1942. [Received June, 1945.]

This first list of 100 fungi of Navarre includes *Macrophoma oleae* on olive and *Polythrincium* [*Cymadothea*] *trifolii* on clover (*Trifolium repens*).

Müller (A. S.) & Chupp (C.). **Las Cercospora de Venezuela.** [The Cercosporae of Venezuela.]—*Bol. Soc. venez. Cien. nat.*, viii, 52, pp. 35–59, 1942. [Received June, 1945.]

Comprised in this annotated list of the 176 species of *Cercospora* hitherto recognized in Venezuela [cf. *R.A.M.*, xvi, p. 343] are 29 new to science, including *C. fagopyri* on buckwheat and *C. fuchsiae* on *Fuchsia*, while among others of economic interest may be mentioned *C. apii* on celery, *C. asparagi* on asparagus, *C. beticola* on beet and spinach, *C. brunkii* on *Pelargonium zonale*, *C. cajani* on pigeon pea, *C. canavaliae* on *Canavalia ensiformis*, *C. canescens* on *Vigna unguiculata*, *Phaseolus mungo*, and *P. lunatus*, *C. capsici* on chilli, *C. caribaea* and *C. henningsii* on cassava, *C. citrullina* on watermelon, *C. columnaris* on bean and *P. lunatus*, *C. cruciferarum* on radish, *C. cruenta* on cowpea, *C. helianthi* on sunflower, *C. hibisci* and *C. malayensis* on *Hibiscus esculentus*, *C. kopkei* on sugar-cane, *C. lactucae* on lettuce, *C. mali* on apple, *C. mangiferae* on mango, *C. medicaginis* on lucerne, *C. musae* [*Mycosphaerella musicola*] on banana and plantain [ibid., xxi, p. 351], *C. personata* on groundnut, *C. purpurea* on avocado, *C. ricinella* on *Ricinus communis*, *C. sesami* on sesame, *C. solanicola* on potato, *C. sorghi* on *Holcus sorghum*, *C. viciae* and *C. zonata* on broad bean, *C. violae* on *Viola odorata*, *C. viticola* on vine (*Vitis labrusca*), *C. zeae-maydis* on maize, and *C. zinniae* on *Zinnia*.

C. fagopyri forms on buckwheat foliage circular, grey-green to brown, faintly zonate spots, 1 to 10 mm. in diameter, and is characterized by hyaline, acicular, straight or slightly curved, indistinctly multiseptate conidia, truncate at the base and tapering at the apex, 50 to 150 by 2 to 4 or up to 350 by 5 μ, borne on single or fasciculate, dark brown, multiseptate, up to 5-geniculate conidiophores, 40 to 150 or up to 300 by 4 to 6 μ.

The spots produced by *C. fuchsiae* on *Fuchsia* leaves are circular or angular, pale to dark brown, developing as they age concentric zones and a narrow, dark margin. The conidiophores of this species are fuliginous, distinctly multiseptate, simple, uni- or rarely bigeniculate, straight or slightly curved, 30 to 130 by 4 to 5·5 μ, and the conidia hyaline, acicular or obclavate, straight or slightly curved, indistinctly multiseptate, truncate at the base, subacute at the apex, 20 to 75 by 2 to 3·5 μ.

Couch (J. N.). **Observations on the genus Catenaria.**—*Mycologia*, xxxvii, 2, pp. 163–193, 78 figs., 1945.

The author describes the life-history and cultural investigations of a fungus, *Catenaria allomycis* n.sp., which was isolated from the soil with its host *Allomyces anomalus*. The thallus of this fungus is similar to that of *C. anguillulae* [*R.A.M.*, vii, p. 375] and it has resting bodies that germinate as in *Blastocladiella cystogena*. Experiments indicate that it is an obligate parasite on species of *Allomyces* and *B. simplex*. On the basis of zoospore structure, methods of discharge, and swimming and resting body structure and germination, the genus *Catenaria* is transferred from the Chytridiales to the Blastocladiales, and Sparrow's subfamily Catenarioideae is raised to family rank as Catenariaceae [cf. ibid., xxiv, p. 250].

Springer (Martha E.). **Two new species of Monoblepharella.**—*Mycologia*, xxxvii, 2, pp. 205–216, 51 figs., 1945.

The author records two new species of *Monoblepharella* recovered from soil samples, namely, *M. elongata* from Mexico and *M. laruei* from Nicaragua.

Bisby (G. R.). **Stachybotrys and Memnoniella.**—*Trans. Brit. mycol. Soc.*, xxviii, 1–2, pp. 11–12, 1945.

Since the publication of his paper on *Stachybotrys* [*R.A.M.*, xxiii, p. 151], the author has received numerous cultures and collections, which show that *S. atra* is common in warmer areas and in the south temperate zone. Most of the cultures resembled the standard English culture described by the author. No evidence was found of geographic variation in *S. atra*. A specimen of *S. atra* from Iowa showed a septum at the base of each phialide; the phialides of *S. atra* seem to differ from the usual ones only in shape.

The type collections of Hansford's three new species of *Stachybotrys* [*Proc. Linn. Soc. Lond., 1942–3*, 1, pp. 34–67, 1943] were also examined. *S. kampalensis*, with conidia 10 to 14 by 6 to 8 μ, falls within the present author's conception of *S. atra*, which includes conidia of this size. *S. nephrospora*, with somewhat curved conidia, may prove to be a distinct variety of *S. atra*. In *S. theobromae* the conidia are given by Hansford as 20 to 28 by 15 to 18 μ on phialides 21 to 28 by 7 to 10 μ. As Hansford states, no more than three phialides are evident. In the dried material mounted in water the author saw no spore longer than about 24 μ, while many measured 17 to 20 by 15 to 17 μ. This collection is the second to be made of a large-spored *Stachybotrys*. The first was *S. crassa*, described fifty years ago in Belgium by Marchal, with 5 to 7 phialides, 17 to 21 by 10 to 12·5 μ, and globose spores, 16 to 18 μ. If this species shows variability comparable with that of two other species of *Stachybotrys*, then *S. crassa* and *S. theobromae* may prove to be the same species.

Cultures and data from Dr. Lilian Fraser of Sydney and R. M. Brien of Auckland show that *Memnoniella echinata* (Riv.) Galloway is common, especially on old cloth in warmer areas. It regularly produces persistent chains of conidia without slime. The cultures agreed with Galloway's description and culture, and the fungus is distinct from *S. subsimplex*.

Strong (M[iriam] C.). **Tomato diseases in Michigan.**—*Circ. Mich. agric. Exp. Sta.* 139, 47 pp., 24 figs., 1945.

Notes are given in this bulletin in semi-popular terms on the symptoms, causes, and control of the chief tomato diseases found in Michigan. A special section is devoted to the control of tomato diseases in general.

Walsh (T.) & Clarke (E. J.). **A chlorosis of Tomatoes in relation to potassium and magnesium nutrition.**—*J.R. hort. Soc.*, lxx, 7, pp. 202–207, 1945.

A chlorosis of tomatoes [*R.A.M.*, xxiii, p. 502], extending upwards from the fourth or fifth leaf from the bottom of the plant until sometimes all except the top leaves are affected, has become familiar in recent years to growers in Eire and is also apparently widely distributed in Great Britain. The disorder was shown by leaf analyses to be caused by magnesium deficiency brought about by high potassium dressings. This condition can be controlled by the liberal use of magnesium sulphate, which, however, leads to a salt concentration likely to favour the development of blossom-end rot and, by injuring the cortex of the roots, to weaken their power of resistance to *Colletotrichum atramentarium*, considered to be the main cause of root rot in tomatoes under Irish conditions, although in itself a weak parasite. The authors recommend cropping as the best method both of bringing

about a proper balance of potassium and magnesium in the soil and of lowering its sulphur status, which is also desirable in controlling chlorosis. They show further that potassic manuring causes magnesium deficiency in many other crops.

JACKS (H.). **Soil disinfection II. Preliminary report on control of damping-off.**—*N.Z. J. Sci. Tech.*, A, xxvi, 6, pp. 357–358, 1945.

Experiments were conducted to determine the value of certain chemicals, previously shown by the author (*N.Z. J. Sci. Tech.*, A, xxvi, p. 186, 1944) to be effective against nematodes, in the control of tomato seedling damping-off (*Pythium ultimum*) [*R.A.M.*, xvi, p. 781]. Standard glasshouse-mixture soil, natural and sterilized, was inoculated with the fungus and after 7 to 10 days treated with the fungicides, transferred to boxes, 18 by 12 by 3 in., and a fortnight later planted with tomato seeds at the rate of 500 per box. The number of seedlings in the steam-sterilized series was taken as a standard, to which germination in the other lots was corrected. Formalin (40 per cent. formaldehyde) 1 in 80 was applied at the rate of $\frac{1}{2}$ gal. per box, and chloropicrin and DD (dichloropropane-dichloropropylene) in two ways, viz., (1) injected directly into the boxes at 2 ml. per 0·3 cu. ft., and (2) injected at half its depth into soil held in a closed container for 48 hours after treatment, chloropicrin at 2 and 4 ml. and DD at the weaker concentration only. All the treatments gave satisfactory results except DD injected directly into the boxes. Chloropicrin and formalin stimulated plant growth, and so did DD in one of the experiments in the closed-container series. Unlike formalin, the volatile chemicals did not modify the physical structure of the soil, necessitating frequent tilling.

ROLAND (G.). **Une nouvelle maladie du Chêne.** [A new disease of Oak.]—*Bull. Soc. for. Belg.*, lii, 1–6, pp. 29–33, 2 figs., 1945.

From 1941 to 1943 the author conducted a series of investigations into a serious oak disease, apparently new to Europe, occurring in a severely affected wood near Gougnies, Belgium. During the first year of attack, the leaves on certain branches become withered in summer; these branches are thin and shortened and the bark turns brown. The following spring, the dead branches leave in the top of the tree gaps which become more numerous every year. Small *Diplodia* pustules develop where the bark is torn. Finally, the tree loses its foliage and dies, sometimes three years after the first appearance of the symptoms. When a thick branch on an affected tree is sectioned, a dark brown liquid exudes from the periphery of the wood.

The disease was found to be due to *D. quercina*, the conidia of which germinate during wet days in summer and enter the branches through wounds, particularly those made by insects. Penetration is probably assisted by caterpillars biting the leaves, the fungus spreading to the branch. It seems unable, however, to spread from a branch to the trunk. Before a branch is killed, there must be present, in addition to infection, disturbance in the water balance, any natural or cultural factor leading to loss of water from the leaves appearing definitely to favour the disease.

Control consists in removing dead and affected trees and dead branches lying on the ground. The gaps in the stand should be replanted with another species, but not with beech or chestnut unless the environment is in every way suitable, since, though no attacks have been observed on these in nature, they both became infected in the author's inoculation tests. Where possible, insect control is desirable.

A survey showed the disease to be present in the vicinity of Gembloux, Seraing, Namur, Rochfort, Thuin, and Couvin. In upper Belgium and the southern part of middle Belgium the disease destroys large numbers of trees every year and thus constitutes a grave danger to the oak forests.

Harris (G. C. M.). **Chemical changes in Beech litter due to infection by Marasmius peronatus (Bolt.) Fr.** —*Ann. appl. Biol.*, xxxii, 1, pp. 38–39, 1945.

Chemical analysis of beech leaves, both infected by *Marasmius peronatus* and uninfected, collected a year after deposition from the deep litter in a pure beech wood in Berkshire showed that *M. peronatus* is unique among fungi at present known in that it is able to utilize the lignin fraction of the litter as its sole source of energy. This lignin it breaks down into a water- or acid-soluble state in which it can be attacked by other organisms. *M. peronatus* may play an important part in the rapid conversion of beech debris to an assimilable form. For the favourable growth of the fungus, a substrate, while not necessarily containing much cellulose, should contain a large proportion of unchanged lignin—a condition more nearly approached in litter than in grassland.

Waterman (Alma M.). **Tip blight of species of Abies caused by a new species of Rehmiellopsis.** *J. agric. Res.*, lxx, 10, pp. 315–337, 4 figs., 1945.

A detailed study of the tip-blight disease of Colorado fir (*Abies concolor*) in eastern Massachusetts previously attributed to *Rehmiellopsis bohemica* [*R.A.M.*, xii, p. 408] showed that the condition is due to a different species, which is named *R. balsameae* n.sp. It has now also been ascertained that in the collections described in the author's report on the geographical distribution of the disease [ibid., xvi, p. 786], only the fungus on native *A. lasiocarpa* found at Edgewood, British Columbia, is identical with *R. bohemica*, while *R. balsameae* occurs in the collections from native *A. balsamea* in northern Maine, from ornamental trees of *A. concolor* in southern Maine and New Hampshire, eastern Massachusetts, Rhode Island, and eastern New York, of *A. fraseri* and *A. nobilis* in eastern Massachusetts, and *A. cephalonica* in Rhode Island.

The first symptom consists in yellowish-pink spots on needles of the current season's growth when the bud scales begin to slough off. The twig bearing these needles generally continues to grow, but before it reaches mature size it turns dark brown or black, and becomes shrivelled, slightly curved, and brittle, and all the needles on it are affected by the fungus and turn yellowish-pink, then dark reddish-brown, and finally grey. The leaf margins roll backwards, so that diseased needles appear narrower than healthy ones, while they are also curved and bent out of their normal pattern of growth. On *A. concolor* small cankers may form round leaf scars where the fungus has entered the twig tissue from an infected needle.

The disease appears first on the lower branches, and the lateral twigs may be killed back to the node, though the terminal twigs may show only scattered infested needles. Severe infection of seedling balsam firs repeated for several years in succession may result in the death of the trees. Spread of the fungus is, however, so largely dependent on seasonal growth and moisture that if two or three seasons of heavy infection are followed by several seasons of light infection, the trees may recover to a remarkable degree. Firs of all sizes and ages are affected.

The fungus is characterized by amphigenous, usually epiphyllous, subepidermal, later erumpent, single or rarely aggregate, globose, black ascomata, which are pseudo-parenchymatous with differentiated periderm on all sides, opaque at the top, papilla-like, rupturing irregularly, and measuring 200 to 250 μ in diameter. The clavate to cylindric asci are short-stipitate, thick-walled, conspicuously thickened at the apex, 5 to 8 μ at the thickest point, straight or curved, measure 81 to 141 by 33 to 41 μ, are 16-spored, and have no paraphyses. The fusiform-elliptic, irregularly arranged, hyaline, 1-septate ascospores measure 31·5 to 49·9 by 6·3 to 12·6 μ. Conidia were not observed.

Inoculation experiments proved the fungus to be pathogenic on *A. concolor* and

showed *A. fraseri* to be susceptible. Small nursery trees of *A. fraseri*, *A. nobilis*, and *A. holophylla* planted in an area of infected *A. concolor* trees were susceptible to natural infection. Cross-infection from *A. balsamea* to *A. concolor* was obtained by planting a young *A. concolor* tree under a heavily infected native balsam fir.

While control is not feasible in forest conditions, satisfactory control was obtained on ornamental white firs by three applications of Bordeaux mixture (4–4–50) with casein spreader at intervals of 12 days. The first application should be made as soon as the new growth emerges from the buds.

Martínez (J. B.). **La investigación de las alteraciones micológicas de la madera. 1er fascículo. Alteraciones del color del madera. Pudrición azul, pudrición verde, corazón roja de Haya, madera pasmada de Haya.** [The investigation of mycological changes in wood. Fascicle 1. Colour changes in wood. Blue rot, green rot, red heart of Beech, 'dozed' wood of Beech.]—lx—116 pp., 25 pl. (2 col.), 43 figs., 2 diags., 2 graphs, Madrid, Consejo Superior de Investigaciones Científicas, 1943. [French, English, and German summaries.]

Wood undergoes two types of change caused by fungi, namely, colour modifications and decay, of which only the former is discussed in this monograph, the first of its kind to be published in Spain, where no work had previously been carried out on a problem of great economic importance.

The studies have already yielded some interesting mycological and taxonomic data, including the presence in the country of three hitherto unreported genera, *Endoconidiophora*, *Chalara*, and *Bispora*, and ten similarly unrecorded species, viz., *Ceratostomella piceae* [*R.A.M.*, i, p. 277; ii, p. 50], with its conidial state *Graphium penicillioides* var. *ungeri*, *C. caerulea*, *E. caerulescens* [ibid., xxiv, p. 37], with its conidial state *Chalara ungeri*, *B. monilioides* (mention of which has been briefly made as an agent of beech decay in the Navarre Province [ibid., xxiii, p. 155]), *Ustulina vulgaris*, *Eutypa flavovirescens*, *Stereum fasciatum*, and *Coriolus* [*Polystictus*] *pergamenus*.

Ceratostomella pini, *C. piceae*, *C. caerulea*, and *Endoconidiophora caerulescens* are responsible for blue rot of pine (*Pinus sylvestris*) at Balsain (Segovía) and Guadarrama (Madrid).

No Spanish statistics are as yet available regarding the annual losses due to blueing. Directions, based largely on American experience, are given for the prophylaxis and control of the defect by appropriate silvicultural operations and antiseptic treatment of the finished boards in an alkaline bath consisting of a mixture of sodium carbonate and sodium bicarbonate at 4 and 5 to 6 per cent., respectively, in dry weather and at 8 and 11 per cent., respectively, during rainy periods. In Spain *Chlorosplenium aeruginascens*, the agent of 'green wood' has been collected on *Quercus ilex*, and *C. aeruginosum* [*Chlorociboria aeruginosa*: ibid., xvi, p. 3] on beech in several localities, including the Irati Forest, Navarre.

Associated with 'red heart' of beech [ibid., xxiii, p. 210] in the last-named district are *Fomes marginatus*, *Ganoderma applanatum*, *F. connatus*, and *Hypoxylon coccineum*, the mycelia of which penetrate through injuries into the parenchyma cells of the heartwood and cause the formation of vesicular tyloses in the vessels. In the course of dissolution the parenchyma cells undergo oxidation, resulting in the formation of brownish-red substances, especially wood gum, which diffuse into the adjacent vessels and fibres. Owing to its relatively low moisture content, the heartwood in general, and the 'red heart' zone in particular, is much more resistant to wood-decaying fungi than the sapwood. 'Red heart' generally develops irregularly, and is apparently composed of alternating pale and dark-coloured zones. The rancid odour, reminiscent of butyric acid, emanating from the affected tissues is a property of the above-mentioned gummy materials into which the starch and other nutrients of the invaded parenchyma cells are transformed. Other features

of 'red heart' are an increase in specific gravity and resistance to compression. Timber from trees affected by 'red heart' does not readily absorb preservatives, and is consequently rejected by the German State railways for cross-tie material if the discoloured zone (*a*) exceeds one-sixth of the surface in transverse section, or (*b*) occurs in the upper portion.

'Dozed' wood is another defect of beeches in the Irati Forest, similar to 'red heart' in the early stages, when it assumes the form of a red, brownish-red, or brown tongue penetrating from the cut surface right through the trunk. After four or five months white rot ensues, and the brownish-red zone is traversed by white bands interspersed with irregular, black, more or less stratified veins. A number of fungi have been found associated with 'dozed' wood in Central Europe, as many as 36 species being listed by E. Jahn in *Dtsch. Forstw.*, xiv, p. 452, 1932 (cited by F. Kollman in *Technologie des Holzes*, pp. 305–310, published by J. Springer, Berlin). In Spain the associated organisms include *U. vulgaris, Schizophyllum commune, Lenzites betulina, Polystictus pergamenus, Trametes cinnabarina, R. gibbosa, F. fomentarius, F. marginatus, G. applanatum.* The fungi thrive in the woody parenchyma of the sap wood, where the atmosphere is suitably humid and the cells contain ample food supplies. Tyloses and wood gum are produced, but the former are less numerous than in the case of 'red heart' and not so well formed.

'Dozed' wood is most prevalent in logs from spring-felled trees piled in humid sites, especially when decortication is delayed and the vitality of the outer annual rings and phloem is consequently maintained for a certain length of time. The symptoms of the disorder in such material become visible at the end of the spring or in early summer, but the development of 'dozing' actually reaches a climax in the autumn and is retarded only by severe winter frosts. The defect occurs in wood with a wide range of internal moisture (37 to 75 or more per cent.), the extensive fluctuations being attributable to the large number of fungi with diverse biological characters concerned in its etiology.

As in the case of 'red heart', dozed wood is only partially amenable to preservative treatment, and its resistance to decay rapidly declines so that after a year or two it is entirely unfit for further use. Losses range from 36 to 60 per cent. Control measures should include winter felling, early decortication, use of clean, protected sites for storage of logs, and the application of preservatives as soon as possible after felling.

Cartwright (K. St. G.) & Findlay (W. P. K.). **Dry rot in wood.**—*Bull. For. Prod. Res., Lond.* 1 (4th Edition), 32 pp., 8 pl., 4 figs., 1945. 1*s.*

Serious and extensive outbreaks of dry rot (*Merulius lacrymans* and other fungi) in buildings after fires caused by air-raids have led the authors to publish a revised edition of this bulletin [*R.A.M.*, xviii, p. 76].

Hatfield (I.). **Information on pentachlorophenol as a wood-preserving chemical.** —*Proc. Amer. Wood Pres. Ass.*, xl, pp. 47–67, 1944.

In this paper, read before the 40th annual meeting of the American Wood Preservers' Association, held in Chicago in April, 1944, the author aims at setting out the characteristics, qualities, and application of pentachlorophenol [*R.A.M.*, xxii, p. 47] as a wood preservative in the light of unpublished data and of experience over the last five years.

Pentachlorophenol has been in commercial use for too short a time for any extensive records of materials treated to be available. It is recorded, however, that an experiment begun in 1936 by the Forest Products Laboratory, Madison, Wisconsin, in which 198 pine posts were treated with pentachlorophenol solutions showed after seven years that all the posts were still in service, none showed

termite damage, and only five disclosed signs of some decay. Of 65 untreated posts set at the same time, 64 are unserviceable and all have been attacked by termites or decay.

Of 200 railway sleepers treated with pentachlorophenol dissolved in a practically colourless petroleum oil, and placed in service on the test tracks of the Cleburn and Cleveland line, Texas, in 1938 and 1939, all were in use and good condition when inspected in 1943.

It is too early to assess with any accuracy the quantity of fungicide required to give adequate protection over long periods of time. It is, however, suggested that pressure-treated materials for use in contact with the ground should usually be given a 10 lb. treatment, using a 5 per cent. solution of pentachlorophenol, or at least the treated wood should have a 0·5 lb. retention of pentachlorophenol per cu. ft. Proper penetration and retention of pentachlorophenol crystals in the wood is all-important, and in order to achieve this a suitable carrier for the treatment is no less so. Tables are presented showing the toxicity of pentachlorophenol to various wood-destroying fungi.

The author concludes by emphasizing the growing literature on the use and value of pentachlorophenol as an industrial preservative.

Wright (E.) & Hartley (C.). **Green lumber shipments need protection.**—*Timberman*, xlvi, 5, pp. 100, 102–103, 2 figs., 1 graph, 1945.

Recent tests in western Oregon and Washington showed that sap or blue stain [*Ceratostomella* and other fungi] in green Sitka spruce [*Picea sitchensis*] and Douglas fir [*Pseudotsuga taxifolia*] sapwood boards is largely controllable by immersion in full-strength solutions of dowicide H, dowicide G, or santobrite [*R.A.M.*, xxiii, p. 507], which reduced the incidence of this defect from 55 per cent. in the former and 72 in the latter species after five weeks in bulk piles to less than 3. Lignasan was also effective against sap stain, but less so than the foregoing against surface moulds, which are, however, so readily brushed off as to be of negligible importance. Used at only quarter strength and extended with borax, the chemicals under discussion gave satisfactory results. In pine wood the agents of sap stain are generally less amenable to treatment: in an experiment involving five months' bulk piling, the maximum amount in any group of boards immersed in full-strength chlorophenate or lignasan was 8 per cent. compared with 69 in the untreated lots. Incipient decay in boards left piled for a year after treatment was reduced to a trace in western hemlock [*Tsuga heterophylla*] and Sitka spruce by lignasan and sodium chlorophenate, and in Douglas fir by a mixture of the same two chemicals at greatly reduced strength extended with borax, while the incidence in the untreated controls amounted to 26, 23, and 36 per cent., respectively. The dilute mixtures of the chemicals obtained by the addition of 3 to 6 lb. borax per 50 gals. solution not only exert a strong preservative action but also decrease skin irritation in workers handling freshly treated timber.

Hager (B.). **Arsenical wood preservatives. The Boliden process in practice.**—*Chem. Tr. J.*, cxvi, 3015, pp. 221–222, 1945.

In this article (which appeared in the *Anglo-Swedish Review* for February, 1945), the author gives details of the application of the Boliden process of timber preservation to Swedish pine poles [*R.A.M.*, xv, p. 414; xvi, p. 649]. The impregnating solution is composed of arsenic acid, sodium arsenate, sodium bichromate, and zinc sulphate, and is introduced into the wood mainly by the open-tank treatment, for which there are now 11 plants in different parts of Sweden, operating up to a capacity of 20,000 cu. ft. per month. The full-cell pressure treatment is used for large-scale work. The poles (or sleepers) are generally steamed for 10 to 12 hours in one tank and then submerged in the chemical solution in another for

24 hours. Swedish pine absorbs about 16 lb. of solution per cu. ft. The sapwood content in the wood used for poles is roughly 60 per cent., and this is completely penetrated by the solution, containing after treatment nearly 1 per cent. by weight of arsenic acid. During 1940, some 1,500,000 cu. ft. of wood were treated in Sweden by the Boliden process, which has also been used in one plant in Norway since 1938.

Fungicidal tests by the wood-block method have shown that arsenic acid contents of 0·05 to 0·08 per cent. are sufficient to repel invasion by the cellar [*Coniophora puteana*] and cross-tie fungi.

The amounts of arsenic retained in the treated wood after 2, 15, and 30 days' leaching were 80, 67, and 64·7 per cent. of the original content, and further observations showed that only a small additional quantity is lost during a five-month period. Promising results have also been given by field tests proceeding at two localities since 1935.

Wilson (J. D.). **Organic fungicides and the control of vegetable diseases in Ohio.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxx, 233, pp. 49–61, 1945.

This is a tabulated summary of the reports published in 24 papers, most of which have been noticed in this *Review*, on the results of experiments in vegetable disease control by various organic compounds, including derivatives of dithiocarbamic acid, chloroquinones, and quaternary ammonium compounds. Judging by the data obtained in one year (1944) in Ohio, zinc dimethyl dithiocarbamate (represented by methasan) appears to be the most generally effective of the compounds tested, closely followed by fermate.

Richardson (J. K.). **Black rot of Rutabagas.**—*Sci. Agric.*, xxv, 7, pp. 415–425, 10 figs., 1945.

Black rot of table rutabagas [swedes] due to *Xanthomonas campestris* [*R.A.M.*, xxiii, pp. 85, 283] has increased in severity since 1940 in many parts of Ontario. It was first reported on swedes in the province in 1907, but did not become of significant economic importance until 1939 40. It also occurs in Quebec and the Maritime Provinces, where, however, it appears to be unimportant.

In 65 samples of commercial seed tested, 0 to 6 per cent. of the seeds were found to be infected, but when 12 seed plants were grown from infected roots, it was not possible to isolate the organism at more than 7 in. from the infected root, and the pathogen was not detected in the seed. The organism was still pathogenic after a year's storage at 35° to 40° F., but remained viable for only four to five months at room temperature.

In a seed disinfection test, experimentally inoculated seed treated with mercuric chloride (1 in 1,000), semesan, ceresan, zinc oxide, spergon, cuprocide, thiosan, arasan, and fermate gave, respectively (average of five separate tests, 200 seeds each), seedlings showing 0·32, 1·34, 1·22, 1·9, 2·14, 1·63, 12·14, 16·71, and 21·06 per cent. black rot, as against 46·17 per cent. for the inoculated but untreated controls.

When steam-sterilized soil was inoculated with finely ground infected swede turnip roots and then planted with seedlings of Essex rape and Purple King and Laurentian swede turnip in November, 1942, the plants being harvested five months later, Essex rape showed 10·7 per cent. infection upwards through the root, 3·6 per cent. infection downwards through the crown, and 10·7 per cent. infection both ways, the corresponding figures for Purple King being 25, 0, and 50 per cent., and for Laurentian 64·3, 10·7, and 17·9 per cent.

During 1943 a critical examination of 20 fields planted with seed disinfected with semesan or mercuric chloride and of 12 planted with untreated seed showed that of the fields with no disease, two were planted with disinfected seed and none

with untreated seed, of those with a trace of disease, 15 were planted with disinfected seed and two with untreated seed, while of those with severe infection, none were planted with disinfected seed and six with untreated seed. It was apparent that under favourable conditions, the disease can spread very rapidly by rain splashing, insect transmission, and working in the crop when the leaves are wet. Many diseased fields showed definite infection centres, generally situated along surface washes or in depressions.

As a result of this work, over 95 per cent. of the seed planted locally in 1944 was disinfected either before packaging or by the growers. The weather favoured infection, but the disease was of little economic importance when seed disinfected with semesan or mercuric chloride was used, though it was severe in some cases where untreated seed was planted.

Growers are recommended to plant only treated seed. A four-year rotation (at least) should be practised, and swedes should not be planted in or adjacent to a field that grew crucifers the previous year. Planting should be carried out in well-drained fields. When the root cellar is cleaned out, refuse should never be put on the manure or compost heap, and after the removal of all debris the cellar should be sprayed with copper sulphate or formalin. If a field of swedes becomes severely infected shortly before harvest, it should be disposed of for immediate consumption.

Wilson (J. D.) & Young (H. C.). **Comparison of various fungicides, diluents, and adhesives in controlling Cercospora leaf spot of Beets.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxx, 233, pp. 62–72, 1945.

This is an expanded account of experiments carried out during recent years in Ohio on the control of sugar beet leaf spot (*Cercospora beticola*), a note on which has already appeared [*R.A.M.*, xxii, p. 508]. Prior to the introduction of resistant strains, the disease was a limiting factor in the production of the crop in some parts of the United States [ibid., ix, p. 696], its virulence in Ohio, for instance, steadily increasing from 1925 to 1935 and reaching a peak in 1938, when the reduction in yield was so heavy that the sprayed plots in an experimental block produced about 5 tons per acre more than the untreated [ibid., xix, p. 688]. In a series of 17 spraying and dusting trials covering the six-year period from 1938 to 1943, inclusive, the average yield increase amounted to at least 20 per cent. over the controls. Taking an average of five different comparisons, spraying gave somewhat better leaf-spot control than dusting, whereas the dusted plots produced larger yields. The average percentages of dead foliage on the sprayed, dusted, and untreated plots were 23, 32, and 75, respectively, and the corresponding yields 21·9, 22·3, and 18·5 tons per acre. Nocturnal treatments were slightly more effective, both as regards disease control and yield increase, than those applied in the daytime.

In comparative tests with six fixed-copper compounds and Bordeaux mixture or copper-lime dust, Bordeaux combated leaf spot more efficiently than the fixed coppers in liquid form, but when all were applied as dusts, some of the fixed coppers proved equal or superior to copper-lime dust. The basic copper chlorides (copper A and copper oxychloride sulphate, known as COC S) gave rather better results than the basic sulphates (tribasic and basicop), while one oxide (cuprocide) was similar to the basic sulphates and another (brown cupric oxide) inferior in the control of *C. beticola*.

In an average of eight tests, the application of 1·5 lb. copper (calculated as the metallic equivalent) per acre reduced the percentage of diseased leaves from 83 to 39 per cent. and increased the beet yield from 16·9 to 20·3 tons per acre. A further increase in copper of roughly 1 lb. per acre brought the incidence of dead foliage down to 30 per cent. and raised the yield to 21 tons, and a summary of all the

available data on copper treatment indicates that 2·5 lb. per acre is a suitable dosage for the object in view.

A comparison of diluents showed no outstanding differences, and the value of adhesives and wetting agents was not clearly demonstrated.

Decoux (L.) & Wauthy (R.). **Étude des moyens culturaux de lutte contre la jaunisse de la Betterave sucrière, effectuée en 1942.** [A study of cultural methods of controlling yellows of Sugar Beet, carried out in 1942.]—*Publ. Inst. belg. Amélior. Better.*, xi, 5, pp. 509–528, 1943. [Flemish, German, and English summaries. Received July, 1945.]

Continuing their studies on the cultural control of virus yellows of sugar beet in Belgium [*R.A.M.*, xx, p. 145], the authors reached the following tentative conclusions. Heavy dressings of magnesia exerted a depressing effect on yield. Transplanting, after forcing, at normal sowing-time increased the growing period, decreased susceptibility to virus yellows, and increased yields. Removal of outer leaves apparently affected with the disease reduced yields, but increased the yield of tops and improved forage quality. When infection was severe, hoeing in August and September appreciably increased the yields of roots, sugar, and tops. Deep cultivation improved the yield and the sanitary condition of the beets. The most effective aphid [*Aphis fabae*] control was given by nicotine, tobacco dust, quassia chips, and sinaphit, while a single water spray killed a high percentage of the aphids. The removal and destruction of the first young plants to become infested with aphids retarded and reduced yellows.

Ken Knight (G.). **Pea diseases in Idaho.**—*Bull. Idaho agric. Exp. Sta.* 253, 13 pp., 7 figs., 1944.

This bulletin provides growers with a succinct account of the pea diseases which occur in Idaho, together with practical recommendations for their control.

Price (W. C.). **Crystallization of southern Bean mosaic virus.**—*Science*, N.S., ci, 2629, pp. 515–516, 2 figs., 1945.

This paper describes the isolation in crystalline form of southern bean mosaic virus [*R.A.M.*, xxiii, p. 203] from highly purified preparations obtained by fractionating the juice from infected Bountiful bean plants, using alternating cycles of high- and low-speed centrifugation or by chemical treatment.

Solutions of the crystalline material produced characteristic symptoms of southern bean mosaic when used to inoculate Bountiful beans, while Early Golden Cluster beans showed lesions at concentrations as low as 10^{-8} gm. per c.c.

Much of the virus remained in the mother liquors, only 10 to 30 per cent. being obtained as crystals. The crystalline material is mostly protein and its homogeneity suggests relative freedom from impurities. Failures to isolate any such material from healthy plants show that the material is not a normal constituent of the bean plant. It has proved to consist of essentially spherical particles small and uniform enough to crystallize under appropriate conditions.

Vovk (A. M.). Тли — переносчики мозаичной болезни Лука. [Aphids—vectors of the mosaic disease of Onion.]—Микробиология [*Microbiology*], xiii, 4, pp. 180–184, 1944.

Ryjkoff and the author in 1936–7 demonstrated the transmission of onion mosaic [*R.A.M.*, xvii, p. 91] by the sap and now report investigations on insect vectors carried out in the greenhouse under controlled conditions. Insects reared on suitable hosts were transferred to infected onion plants for two to five days and then batches of 10 to 20 insects were put on young, healthy onion leaves. Infection

occurred after about 11 days with the aphids *Myzodes* [*Myzus*] *persicae*, *Neomyzus* [*M.*] *circumflexus*, and *Aulacorthum* [*Macrosiphum*] *pelargonii*. The mosaic is a very destructive disease, causing great reduction in the yield of bulbs and seeds. It overwinters in the bulb. The author reiterates his opinion that this disease differs from the onion yellow dwarf prevalent in the United States both in the nature of the virus and the symptoms, and that the disease described by Bremer in 1937 resembles the Russian mosaic. Repeated attempts to inoculate lily, hyacinth, and *Narcissus* with onion mosaic failed, and the mosaics on these Liliaceae are considered distinct from onion mosaic. It is recommended that onion seed should be obtained from healthy plants and not planted near seedlings of the former year or in ground on which infected plants have grown. To control the aphid vector is of the highest importance.

By analogy with methods used in the case of potato only stocks registered as resistant should be used to provide seed. Great interest attaches to the perennial onions Crezoon, Slezin, and Bootoon, which are reported to show only 1 per cent. infection as against 34 per cent. in the ordinary 'turnip' onion.

Ken Knight (G.). **Control of storage diseases of Onions.**—*Circ. Idaho agric. Exp. Sta.* 92, 4 pp., 2 figs., 1944.

The author of this popular leaflet states that the most serious storage diseases of onions in Idaho are neck rot [*Botrytis allii*], bacterial soft rot [*Erwinia carotovora*], and *Fusarium* [*vasinfectum* var. *zonatum*], root and bulb rot (*Sclerotinia*) [*sclerotiorum*] and black mould [*Aspergillus niger*] also being important. The control measures recommended include field sanitation, care in handling bulbs, and good storage conditions. Bulbs for planting should be stored at 45° to 55° F. If they are held near freezing, the temperature of the room should be raised to 45° to 55° for a month at the end of the storage season.

Ling (L.) & Tai (M. C.). **On the specialization of Bremia lactucae on Compositae.**—*Trans. Brit. mycol. Soc.*, xxviii, 1–2, pp. 16–25, 1 fig., 3 graphs, 1945.

Between 1942 and 1944, the genus *Bremia* was collected near Chengtu, China, on lettuce, *Lactuca indica*, *L. chinensis*, *Crepis japonicus*, *Sonchus oleraceus*, *Taraxacum mongolicum*, and *Saussurea affinis*, the forms from these hosts falling into three groups, based on the dimensions of the sporangia. The fungus from *Saussurea* (500 measurements) had large sporangia (22·9 to 37·2 by 20 to 32·9 μ), the fungi from *L. chinensis* and *C. japonicus* had small sporangia (10 to 21·5 by 8·6 to 20 and 10 to 21·5 by 7·2 to 19·2 μ, respectively), while the others formed a third group with sporangia of medium sizes. The fungus from *Saussurea* is regarded as a distinct species, for which the name *B. saussureae* Sawada is accepted; the others are regarded as *B. lactucae* and forms of that species. Successful cross-inoculations were made between lettuce and *L. indica*, but the other fungi were specialized to their natural hosts.

The taxonomy of *Bremia* is reviewed, and the following revision of nomenclature is proposed: *B. lactucae* Regel (syn. *B. elliptica* Saw.) on lettuce and *L. indica*; *B. lactucae* Regel f. *chinensis* f. n. on *L. chinensis*; *B. lactucae* Regel f. *sonchicola* (Schlecht.) comb. nov. (syn. *Botrytis sonchicola* Schlecht, *Bremia sonchi* Saw.) on *Sonchus oleraceus*; *B. lactucae* Regel f. *taraxaci* (Ito & Tokunaga) comb. nov. (syn. *B. taraxaci* Ito & Tokunaga) on *T. mongolicum*; and *B. lactucae* Regel f. *ovata* (Saw.) comb. nov. (syn. *B. ovata* Saw.) on *C. japonicus*.

Experimental evidence demonstrated that the sporangial dimensions could be influenced by temperature and by age. It is suggested that *Bremia* survives the hot part of the summer, when high temperatures prevent its growth, in infected seeds.

DAY (W. D.). **Report of the subcommittee on phytopathological technique. Chemical control of molds and bacteria on Cucurbit seeds.**—*Proc. Ass. Off. Seed Anal. N. Amer.*, 1942, pp. 40–42, 1943. [Lithoprint. Received June, 1945.]

After pointing out that seedlings of most species of Cucurbitaceae are highly susceptible to damping-off due to *Pythium debaryanum*, *P. ultimum*, *Phytophthora* spp., and *Rhizoctonia* [*Corticium*] *solani*, and that it has been found difficult in California to secure a stand of cucumbers or muskmelons in soils inhabited by these organisms, the author states that recently, however, seed treated with ceresan, cuprocide, spergon, semesan, or thiosan has produced fine stands in damping-off soils.

During 1942, a study was made to demonstrate the decay of seeds and sprouts by *Rhizopus nigricans* [*R. stolonifer*], *Penicillium* spp., and *Bacillus carotovorus* [*Erwinia carotovora*], to compare the value of various chemicals in the control of these organisms, and to determine the phytotoxic effect of the materials. Each member of the subcommittee received treated seeds of mixed cucumber, mixed muskmelon, Connecticut field pumpkin, green Hubbard squash, summer crookneck squash, and summer straightneck squash. The fungicides used were: (dips) 0·1 per cent. suspension of new improved ceresan and 0·75 per cent. suspension of American Cyanamid Chemical Corporation 154–6 B (betachlorethylethoxymercury-hydroxide), and (dusts) ceresan, thiosan, cuprocide, U.S.R.#601 (diluted to 5 per cent. organic formaldehyde), and U.S.R.#601 (diluted to 4 per cent. organic formaldehyde). The seeds were treated by shaking with an excess of dust for two minutes and then removing all excess material, or by soaking in a large volume of the dip suspension for 60 seconds, followed by drying. All the tests were exposed to alternating temperatures of 30° C. by day and 18° to 20° by night, paper towels being used as germination substrates.

The data obtained (averages from the final readings of three collaborators) showed that thiosan gave the best mould control and bacterial inhibition, while it caused almost no chemical injury. This material should be substituted for ceresan and new improved ceresan whenever possible. Also, it affords excellent protection against damping-off. Being only slightly soluble in water, it exercises a lasting protective action, whereas that of the ethyl mercurials is evanescent. With a long germination period, the superiority of thiosan becomes more apparent. Red cuprous oxide was highly fungicidal, but phytotoxic. Ceresan, new improved ceresan, and 154–6 B, if used at greater concentrations than in these tests, eliminate all mould growth. U.S.R.#601 is a non-metallic dust [*R.A.M.*, xxii, p. 291], the use of which should be encouraged in order to conserve copper and mercury. Even when diluted with two or three parts of talc or flour, it is a relatively effective fungicide. Applied at full strength, it completely eliminated mould, but produced distinct chemical injury.

PONTIS (R. E.). **Phytophthora capsici en frutos de Zapallito de tronco.** [*Phytophthora capsici* on Squash fruits.]—*Rev. argent. Agron.*, xii, 1, pp. 17–21, 1 pl., 1945. [English summary.]

Phytophthora capsici was first observed attacking squash (*Cucurbita maxima*) fruits in Mendoza, Argentina, in 1940, but no record of its occurrence on this apparently new host has hitherto been published. S. Zabala also reports the pathogen on squash in Salta. The symptoms correspond in the main with those already described on cucumber [*R.A.M.*, xx, p. 44], melon [ibid., xvi, p. 793], and watermelon [ibid., xix, p. 513]. The fungus causes a generalized wilt of the plant and a white rot of the fruits, and it is therefore recommended that the former term be applied in reference to infection of the stem and foliage and the latter to that of the fruits. Positive results were given by inoculation experiments on

squash, using Wiant and Tucker's technique [loc. cit.], melon, watermelon, chilli [ibid., xxi, p. 380], and tomato [ibid., xx, p. 501].

PRINCE (A. E.). **Fungi isolated from Peanuts collected in South Carolina in 1944.**—*Plant Dis. Reptr*, xxix, 14, pp. 367–368, 1945. [Mimeographed.]

Isolations from 222 groundnut seeds from 45 collections made in South Carolina in 1945 showed fungi present in 145. The organisms isolated [cf. *R.A.M.*, xxiii, p. 329] from five or more groundnuts and the frequency of their occurrence were as follows: *Alternaria* spp. from 10 seeds, *Diplodia natalensis* 5, *Fusarium oxysporum* 8, *F. reticulatum* 6, *F.* spp. 46, *Penicillium* spp. 5, *Sclerotium bataticola* [*Macrophomina phaseoli*] 8, *S. rolfsii* 6, *Trichoderma viride* 9, and sterile fungi 10. Little is known about the pathogenicity of these fungi, or their relative importance in seed groundnuts, but the list cited is believed to be a fair representation of groundnut seed-borne fungi in South Carolina. It is significant that these organisms are often correlated with an internal decay that may well be similar to the 'concealed damage' reported by C. and J. P. Wilson (*Plant Dis. Reptr*, xxix, pp. 61–63, 1945).

VITORIA (E. R.) & CERESA (M. C. D.). **Eficacia de los tratamientos 'antiperonospóricos' a base de sales de cobre, en la Provincia de Mendoza.** [Efficacy of 'anti-*Peronospora*' treatments with a copper salts base in the Province of Mendoza.]—*Rev. argent. Agron.*, xii, 1, pp. 30–37, 1945.

A tabulated account is given of replicated block experiments in the control of vine downy mildew (*Plasmopara viticola*) in Mendoza, Argentina, with three commercial products and Bordeaux mixture (*a*) 1 per cent. neutral, (*b*) 1 per cent. alkaline, (*c*) 2 per cent. alkaline, (*d*) 2 per cent. neutral, and (*e*) 2 per cent. alkaline, all being applied once only, on 23rd December, 1943, except in the case of (*e*) with which a second treatment was made on one series of plots on the following 27th January. Statistical analyses of the data by the method of variance resulted in the rating of one of the commercial products, 1 per cent. Bordeaux mixture neutral, and 2 per cent. Bordeaux mixture alkaline as 'good', and that of 2 per cent. Bordeaux mixture neutral as 'very good'. The superiority of the last-named, however, was not sufficiently striking to outweigh the additional cost and care needed in its preparation, and for practical purposes the 1 per cent. neutral or the 2 per cent. alkaline is recommended, the latter being preferable where experience in adjustment of the solution to neutrality is lacking. One treatment about mid-December should be adequate.

SOUKHOV (K.), VOVK (A. M.), & ALEXEEVA (Mme J.). Вирусные болезни растений в Киргизии. [Virus diseases of plants in Kirghiz.]—Микробиология [*Microbiology*], xiii, 5, pp. 256–260, 1944.

During their stay in Frunze the authors noted the presence of the following viruses: tobacco mosaic on tobacco, tomato, chilli pepper (*Capsicum annuum*) (50 per cent.), and eggplant (0·5 per cent.); tomato aucuba mosaic (a strain of tobacco mosaic); a ring spot of tobacco; tomato 'stolbur' [tomato big bud] not very frequent on tomato, tobacco, pepper, and eggplant; necrosis mosaic of potato resembling acropetal necrosis [due to potato virus Y]; potato aucuba mosaic (uncommon); and cucumber mosaic poorly developed on cucumber and melon. Mosaic of winter wheat occurred to a noteworthy extent, causing rosette symptoms with yellow-green stripes and spots on the leaves. Search for the 'zakuklivanie' mosaic [pseudo-rosette] of grasses [*R.A.M.*, xxiv, p. 13] was unsuccessful and several virus diseases common in European Russia were absent. A number of other virus diseases, not identified, are briefly recorded.